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Impact Extrusion of Aluminum

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Aluminum products, though no longer novel, continue to appear in increasing variety. A still wider field for this metal is opened by the latest process which makes possible the forming of unusual shapes

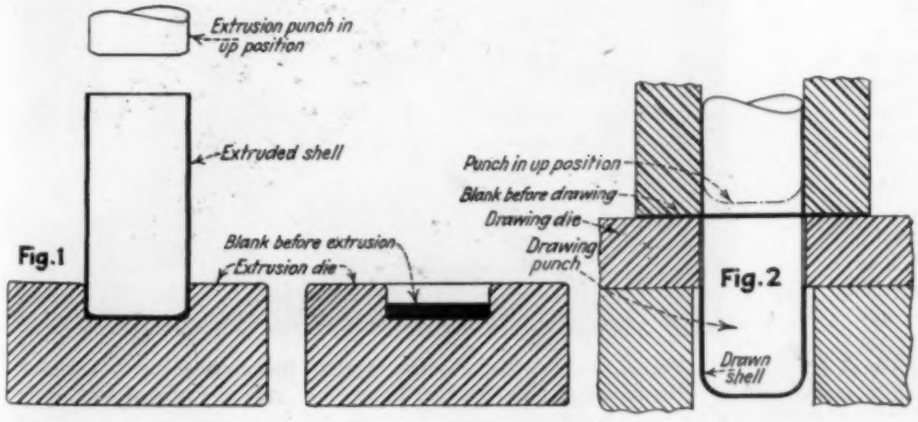
FOR THE extrusion of aluminum, two different processes are employed: the hydraulic and the impact. The hydraulic process, which is the older and better known, is commonly used in the production of many special and standard shapes of molding and in the manufacture of some bar, rod and tubing. Extrusion of this type is generally done hot, and in comparison with impact extrusion, is relatively slow.

In the impact process, extrusion is usually done cold. Large presses, operating at a high rate of speed, convert simple slugs, or blanks, into many unusual and fantastic shapes—shapes which it would be uneconomical to produce by any other process or sequence of processes. Many different combinations of forging or stamping and extrusion are possible; articles can be formed in one operation by impact extrusion which would require several different operations if made in any other manner.

The impact extrusion process represents one of the latest improvements in the art of working aluminum. While this process is an outgrowth of the extrusion of metals in general, the characteristics of aluminum have largely been responsible for this interesting and extensive development. In the annealed state, the metal is soft, ductile and malleable, thus making it easy to extrude. It hardens as a result of the cold working it receives during the extrusion operation, which adds strength and stiffness to the finished product; yet, if these properties are not desired, the extruded article may be made soft and pliable by annealing, or in the case of some of the alloys, even stronger by heat-treating.

A complete understanding of the possibilities of the impact extrusion process should prove to be of assistance to the designer and the engineer, since through its application it is frequently possible to simplify design and reduce the cost of fabrication. In one sense, the applications for impact extrusion and drawing overlap; in general however, each process has its own field, which is more or less clearly defined.

Figs. 1 and 2 illustrate the fundamental differences between the extrusion and drawing processes as applied to a simple cylindrical shell. In forming a can or shell by the impact extrusion process, a thick, flat slug, held in a shallow cup-shaped die, is compressed by a punch, part of the metal in the blank flowing upward to form the walls of the can. When the drawing process is employed, a thin blank of larger diameter is drawn by the punch into the die. The impact extrusion process resolves itself into a squirting operation, requiring extra heavy machinery of special design and tools of the strongest steel to withstand the tremendous stresses, as extremely



Although the result sought is often the same, the metallic flow caused by extrusion is entirely different from that caused by drawing. Fig. 1 illustrates the extrusion method, wherein a thick blank is forced upward around the punch. In Fig. 2, a comparatively thin sheet is drawn by the punch as it passes through the die opening

high pressures are necessary to make the metal flow. On the other hand, much lighter equipment can be employed in the drawing process, which lacks the element of shock or impact and results in a more gradual stretching or ironing out of relatively thin metal to conform to the shape of the drawing tools.

With few exceptions, the cost of extrusion tools is considerably less than that of the tools used in the drawing process. This is especially true where the length of the shell is sufficient to require several drawing operations, since with the extrusion process it is possible to produce a shell of almost any properion in but one operation and with but one set of tools by merely varying the gage of the blank.

Length-diameter Ratio

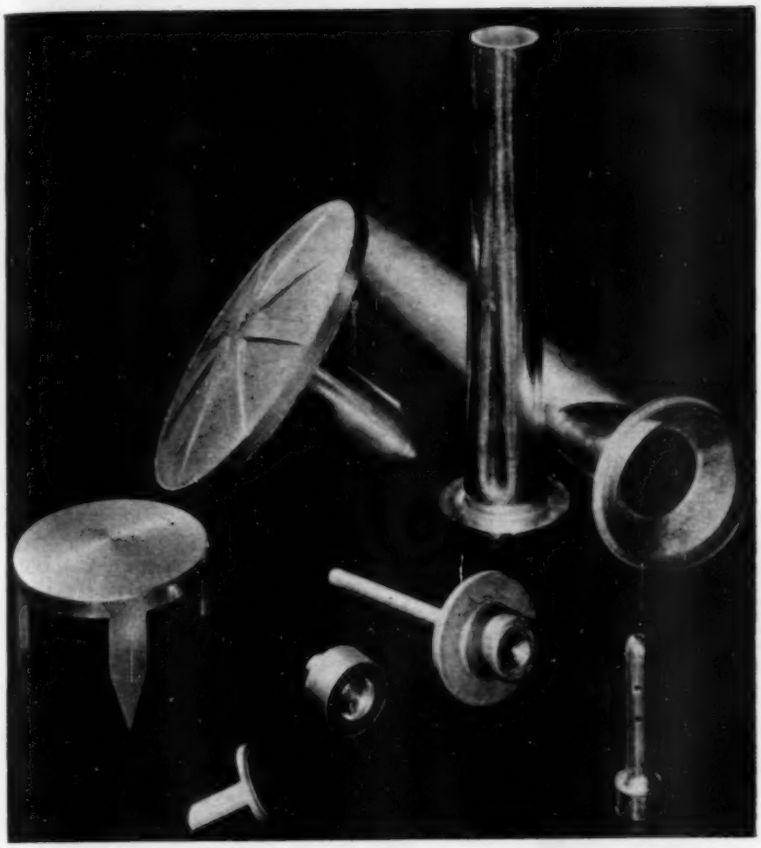
Many radio shields and flat-bottomed cans are made both by impact extrusion and by drawing. The relation between the length and diameter of the can largely determines which process is the more economical. Shallow drawn shells are cheaper to manufacture than extruded shells of similar proportions, but cost of drawn shells rises rapidly with increasing length, as a result of the additional drawing operations that are necessary to produce the greater lengths. For plain, flat-bottomed cans or shields with slightly rounded or conical ends, it will be found that the extrusion process is usually less costly where the length-diameter ratio is greater than one and one-half.

While cost is an important item in determining the process to be used in the production of a can, there are other limiting factors to be considered. The nature of the extrusion process makes it possible to produce cans with sharp corners between the closed ends and side walls. A corner radius of 1/32 in. may easily be obtained. In general, the bottom of an extruded can is slightly thicker than the side walls and has a fillet inside at the corner to reinforce it at this point. These features, of course, add strength and rigidity to the extruded can, while the severe cold working the metal receives during the extrusion operation produces unusual stiffness in the can as a whole. Extruded cans, with their stiff, heavy ends, reinforced corners and rigid side walls, are therefore especially suited when subjected to severe usage.

Cans which are oval or rectangular in shape may be extruded with practically the same ease as cylindrical ones. The bottom and side corners of rectangular shells can be made as sharp as desired without the danger of the metal in the corners being thinned out and thus weakening the can.

Radio shields of certain types and sizes present an ideal application of impact extrusion

Bosses, lugs, rivets, stems, necks, indentations or embossed figures may be produced on the ends of aluminum cans



When combined with forging or stamping, impact extrusion may be successfully employed in the production of many special shapes

By polishing, enameling, lithographing or alumilite coloring many attractive finishes may be applied to aluminum cans

There are, of course, many drawn shells of irregular shape or with tapered or curved sides that obviously cannot be made by the extrusion process. Conversely, there are many modifications of the straight-sided shell that can only be made by this process. Such modifications include bosses, lugs, rivets, stems, necks, indentations or embossed figures on the closed end of the can or shell. These irregularities may be either projections or recesses and may be placed on either the outside or inside of the closed end. They cannot, of course, be placed on the side wall, which ordinarily must be perfectly straight. However, under certain conditions, the section of the side wall may be varied somewhat.

In addition to the forming of cylindrical, oval and rectangular shells, the impact extrusion process is employed in the production of many special shapes, some of which are a combination of forging or stamping and extrusion. The extruded portion may be either solid or tubular in shape.

The familiar collapsible tube, used for packaging shaving creams, tooth pastes, ointments, toilet preparations, food products, lubricants, adhesives and paints, is made by this same impact extrusion process. The aluminum tube was developed during the World War as a direct result of a shortage of the metals commonly employed at that time for collapsible tubes. In this development, the workability and versatility of aluminum proved a distinct asset, and today, millions of collapsible tubes are made in aluminum on automatic machinery especially developed for the fabrication of this type of container.

Hooker Process

Another well known product of the impact extrusion process is Hooker tubing. Fig. 3 shows diagrammatically the arrangement of the tools for the making of this type of tubing. Instead of the metal squirting up around the punch, it flows down around the point of the punch through an opening in the die. In the usual extrusion process, the clearance is between the punch and the outer diameter of the die cavity, with the result that the metal flows through this opening up around the punch. In the case of the Hooker process, the large diameter of the punch closely fits into the outer diameter of the die pocket, there being a clearance between the punch point and the opening in the bottom of the die through which the metal extrudes downward. The shoulder of the punch furnishes the necessary pressure on the blank to cause this flow in the metal.

The presses used in the production of

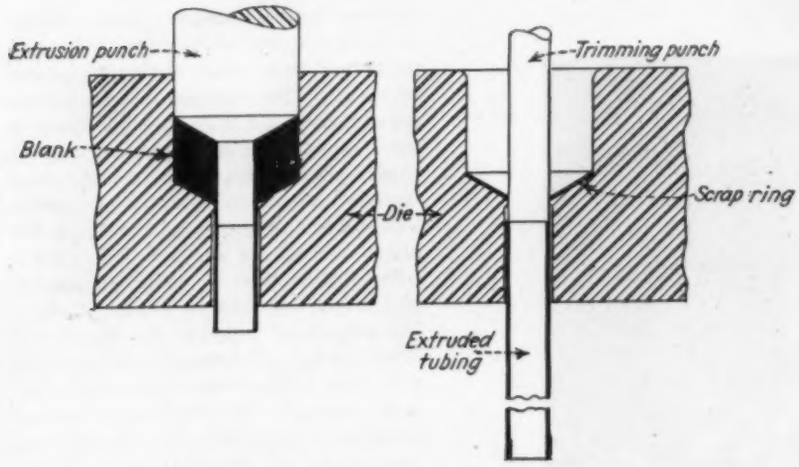
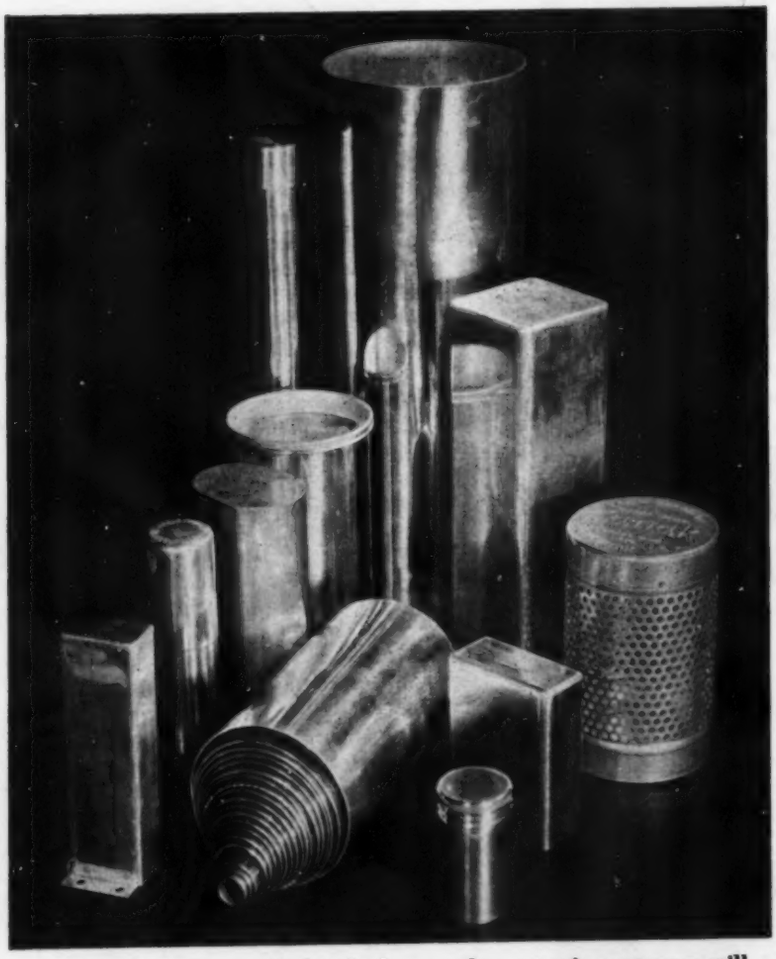


Fig. 3—Reversing the standard process, the Hooker extrusion method forces the metal downward through an opening in the bottom of the die



In addition to cylindrical shapes, the extrusion process will produce parts with rectangular, oval or irregular sections

Hooker tubing have an extruding punch and a trimming punch mounted on a slide which shifts to permit first one and then the other to enter the die. After the extrusion stroke, the tube is left in the die with a thin shoulder section. On the next stroke, the trimming punch enters the die, shears off the shoulder section, pushes the tube through the die, then lifts the ring of scrap out of the die where it is stripped off. Although these presses are quite different from those used for the usual extrusion process, the extrusion principle is much the same.

Many shapes, heretofore considered impossible to produce, can now be made by impact extrusion, thus opening up new possibilities for simplifying designs and cheapening construction and assembling costs of many manufactured articles. Extruded cans or shells may often be fabricated to a further degree, as for example, in the spinning of aluminum bottles or in the fluting of tubular electrolytic condenser anodes.

The cylindrical extruded can, being seamless, may be enameled and lithographed like a collapsible tube with effective results. The Alumilite process, which comprises the anodic oxide coating and coloring of aluminum, offers exceptional possibilities for beautiful color effects. For certain purposes, the natural finish of aluminum is desirable. This may be a highly polished, dipped or satin finish.

The applications of aluminum products made by the impact extrusion method include: flat-bottom cans and canisters for a wide variety of purposes; radio tube, coil and transformer shields; electrolytic condenser anode stems, tubular anodes and cathode cans and containers; foil condenser cans and casings; collapsible tubes; grease gun, door check and pump cylinders; water heaters, filters and softeners; ignition coil cans; electric heater shells, rubber dipping forms; casings; flashlight and cartridge cases; textile bobbins and sleeves; sanitary cans; fire extinguishers; bottles and necked containers; pill boxes and vials, stuffer spouts; refrigerator drains; percolator pumps; traffic markers; fuse links; and golf tees.

Other articles made from extruded cans that are enameled, lithographed, lacquered, polished, plated or Alumilited, include: cosmetic jars; deep bottle caps and bases; cigarette, flashlight, lip-stick and hair pencil cases; and tumblers, ash receivers, shakers and a great variety of novelties.

Small diameter Hooker tubing, finished in various ways, is used for mechanical pencil, pen and pocket flashlight cases; thermometer cases; brush ferrules; spacers and sleeves.

Blueprints Used as Templets

JOHN AURES

We had a large quantity of short pieces of 6-in. pipe in which numerous small holes were to be drilled. To lay out for all the holes would have been a tedious and expensive job, so we made a drawing, of a length that would just encircle the pipes and on it we laid out the positions of the holes.

From this drawing we made as many blueprints as there were pieces of pipe to be drilled. Having pasted a blueprint around each piece of pipe, it was an easy matter to prick punch through the marks.

Are the Railroads Licked?

A well-known railway shop executive, who prefers to remain anonymous, admits certain weaknesses in present methods and morale but is confident they will be overcome

TOO MANY railroad men of my acquaintance have adopted "What's the use" as their slogan, and there is no better way to be licked than to think you are. Personally I think we have just begun to fight. We railroaders took away the business of the stage coach and put a crimp in the canals without batting an eye. But when the trolley, automobiles, trucks and buses came along we threw up our hands and tried to continue our monopoly by legislation. We want the government to keep out of the railroads but to interfere with all our competitors. The game isn't played that way.

Too Many Traditions

We have too many traditions in the railroad shops. We need new blood or a violent stirring up of the old. Our shop men, from superintendents down, need educating in modern shop methods. Our higher executives also need to get a different viewpoint of the functions of railroads. It is our job to furnish transportation for the masses of citizens, at as low a cost as is consistent with safe and economical operation. And we don't begin to know how low such costs can be. We have paid too much attention to de luxe trains and too little to the great mass of people who travel from choice or necessiy. We advertise to give the luxury of a club or a hotel and most of the travelers know nothing about either. Our train crews give careful attention to Pullman passengers, take off their hats as they go through the diners, and too often bawl out a day coach passenger when he asks a civil question. We drive the passengers to the buses and then wonder why they leave us.

Transportation economies can be made all along the line, from the traffic agent's office down. The mechanical department can do a lot; it should not be expected to do it all. But until we have cleaned house ourselves and brought our shop costs down nearer where they belong, we needn't worry about the other departments.

One thing over which we shop officials have little control is the unnecessarily large number of types of motive power. We need more standardization so that less money is tied up in spare parts. I know one division point that maintains about 75 kinds of locomotives and carries at times half a million dollars worth of parts. Standardization doesn't mean stagnation—see what the automobile men have done in the way of standardizing many parts. Tools cost less and money is saved all along the line. Too many of our special devices and designs have been adopted to please the fancy or to fatten the pocketbooks of officials who draw a royalty on patents.

If you don't believe that shop executives need educating, ask them what new tools they need and note the answers. A lot of them are content with what they have although their equipment is from 10 to 30 years old. How many shops have efficient or accurate quartering machines? Mighty few. How many are less than 10 years old? The old machines delay repairs and cannot do a good job.

More Millers Needed

Planers have a legitimate place in the railroad shop but are often used on work that should be done on the miller. On shoes and wedges, and driving boxes, the miller can cut costs tremendously if, and I emphasize the *if*, the purchasing agent buys decent castings. I know of cases where they went back to planing on account of cutter costs, and all because the purchasing agent saved a fraction of a cent a pound on castings that were full of scrap and had hard spots.

Many car-wheel presses advance the ram so slowly that you have to sight it by a post to see its motion. How many blacksmith shops have a butt welder? And yet they save time and labor to a surprising degree. How much power plant equipment is modern or takes advantage of the improvements that greatly reduce power production costs? Pneumatic hammers and other air and electric tools are generally inefficient from lack of care in handling and in overhauling. They are practically worn out in many shops and waste a tremendous lot of time.

Rebuild Morale

Besides the morale of the shop foreman and the men is badly warped at present. Perhaps it is inevitable under the present depression. But it has cost and will cost a lot of money to build it up to anywhere near an efficient state. Lay-offs and discharges have not always been handled with the best judgment. You often lose less money in the long run by keeping the higher priced men. And that should interest real managers.

One of the first steps in the education of railroad shop executives, and the men also, is to squash the old notion that they cannot use methods and ideas from other shops because railroading is "different." The minute you believe your particular job is "different" you begin digging a rut for yourself—and the deeper it gets the harder it is to get out of. No railroad shop can adopt automobile methods in toto, but most of them can grab off a few ideas that will save them money when they pry their minds away from the "different" notion.

Railroads are not going out of business. There is no reason why they should not earn a fair return on a fair valuation. But it isn't going to be done by grouching about buses and other grievances. We can reduce costs and improve service if we put our minds to it as a real problem. We can't be licked if we really fight for future business!

Contour Calculations for Forming Tools—II

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IN THE first article of this series, it was pointed out that a flat finishing forming tool could be ground in three different ways, which would affect the method of determining its contour. These grinding methods are as follows:

1. At 90 deg. with the sides of the tool, the highest point on the tool to stop just on the certain line of the product.
2. At 90 deg. with the sides of the tool, all points to pass the center line of the product.
3. At an angle of less than 90 deg. with the sides of the tool. This tool may also pass the center line of the product.

For Method 1, the calculations were given in the preceding article. Those for Methods 2 and 3 will now be analyzed.

Fig. 14 is an enlarged sketch of the tool in position for finishing the part shown in Fig. 13. The roller bearing cone illustrated is the same as that used as an example in the preceding article (*AM*—Vol. 76, page 893). Fig 15 is a layout of the tool profile. For this type of tool, which falls under Method 2, the roll that backs up the tool will enter into the calculations. We will make the large diameter of the roll 1,500 in., and this diameter will engage the work right at Point 2. The width of the roll will be *A7* minus 0.025 in. for clearance. Angle *B1* should in this case be a little greater than for the tool described in Method 1. An angle of 2 deg. will work satisfactorily for any kind of steel, and we will make angle *B2*, 20 deg., which gives a total of 22 deg. for *B3*.

B4 (large radius of the roll) + *A2* = *B5*
B5 + *A1* = *B6*
B5 + *A2* = *B7*
B5 + *A3* = *B8*
B5 + *A4* = *B9*
B5 + *A5* = *B10*

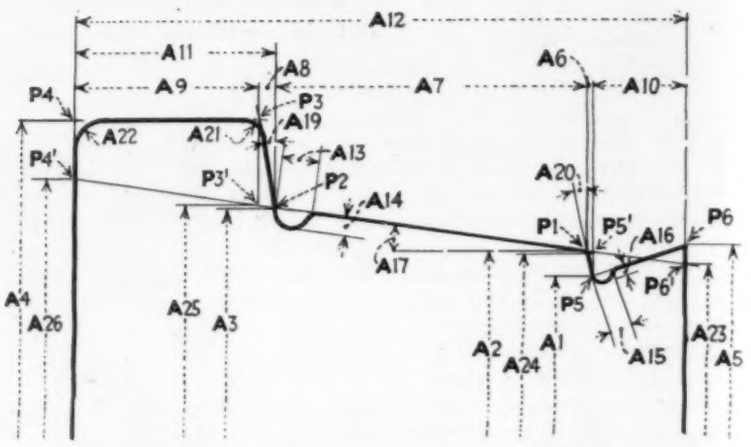


Fig. 13—In the preceding article, a flat forming tool was calculated for the roller bearing cone illustrated. Two other methods are presented for tooling this same job

$B6 \times \sin B2 = B11$

$\frac{B11}{B7} = \sin B12$

$B6 \times \cos B2 = B13$
$B7 \times \cos B12 = B14$
$B14 - B13 = B15$
$B15 \times \cos B3 = B16$

$\frac{A6}{B16} = \tan B17$

$\frac{B11}{B8} = \sin B18$

$B8 \times \cos B18 = B19$
$B19 - B14 = B20$
$B20 \times \cos B3 = B21$

$\frac{B21}{A7} = \tan B22$

$B22 + B17 = B23$

$\frac{B11}{B9} = \sin B24$

$B9 \times \cos B24 = B25$
$B25 - B19 = B26$
$B26 \times \cos B3 = B27$

$\frac{A8}{B27} = \tan B28$

$B28 + B22 = B29$

$\frac{B11}{B10} = \sin B30$

$B10 \times \cos B30 = B31$
$B31 - B13 = B32$
$B32 \times \cos B3 = B33$

$\frac{B33}{A10} = \tan 34$

$\frac{B16}{\cos B17} = B36$

$B36 \times \cos B23 = B37$

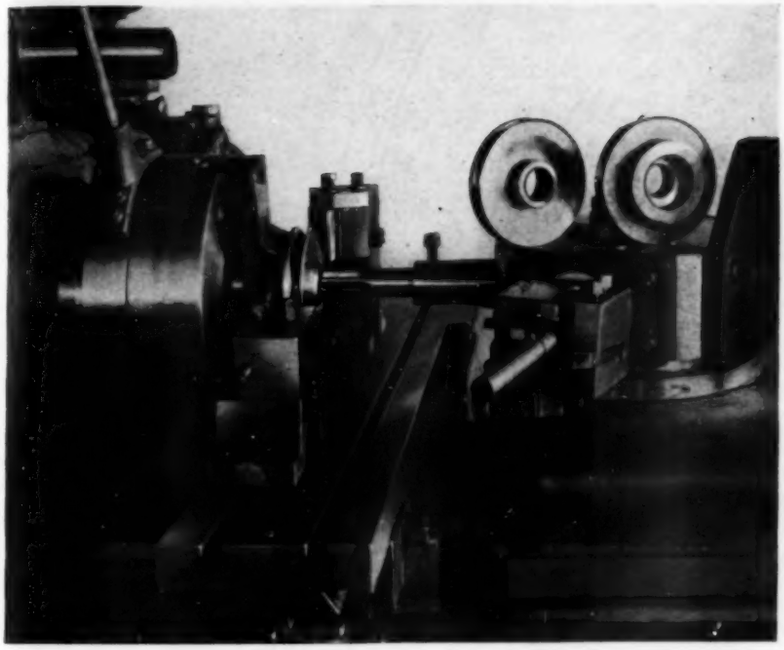
$\frac{A7}{\cos B22} = B38$

$\frac{B27}{\cos B28} = B39$

$B39 \times \cos B29 = B40$
$B41$ (same as $B32$ for Method 1)
$B42$ (same as $B33$ for Method 1)
$B43$ (same as $B34$ for Method 1)
$B44$ (same as $B35$ for Method 1)

A flat finishing tool, ground according to Method 3, will now be calculated. Fig. 16 is an enlarged sketch of the tool in position for finishing the part shown in Fig. 13 and Fig. 17 is a layout of the tool profile. This type of tool is the most accurate, but more care must be taken in regrinding or sharpening the cutting edge, as it must be ground at an angle less than 90 deg. with one side of the tool. We will call this angle the "vise angle."

After having decided upon the tool clearance angle and the rake angle, which will be the same as for Method 1, a base line should be established on the



One flat roughing tool and one flat finishing tool are used to form the outside diameter of a fan pulley on a P & J automatic

product. This base line should be an extension of the longest or the most important surface on the production. In this case, we will draw the base line through Points 1 and 2, and let it extend beyond both ends of the product. Then draw lines from each point that does not fall on this base line perpendicular to the axis of the product, and where these lines and the base line intersect, we will get new points *P3'*, *P4'*, *P5'* and *P6'*. The distance perpendicular to the axis of the product from these points to the base line should then be calculated. All other characters are taken from Fig. 3 (*AM*—Vol. 76, page 894). If a line is drawn perpendicular to the axis of the product from any point other than Points 1 and 2 until it intersects the base line, the point of intersection will fall on the center line of the product. Since Points 1 and 2 have been calculated to fall on the center line of the product, the base line will coincide with this center line throughout its length.

Referring to Figs. 16 and 17, the calculations follow:

$$A3 - A2 = B4$$
$$B4 \times \sin B2 = B5$$
$$\frac{B5}{A7} = \tan B6 \text{ (vise angle)}$$
$$B4 \times \cos B1 = B7$$
$$\frac{B7}{A7} = \tan B8$$
$$A25 \times \sin B2 = B9$$
$$\frac{B9}{A4} = \sin B10$$
$$A25 \times \cos B2 = B11$$
$$A4 \times \cos B10 = B12$$
$$B12 - B11 = B13$$
$$B13 \times \cos B3 = B14$$
$$A8 \times \tan B8 = B15$$

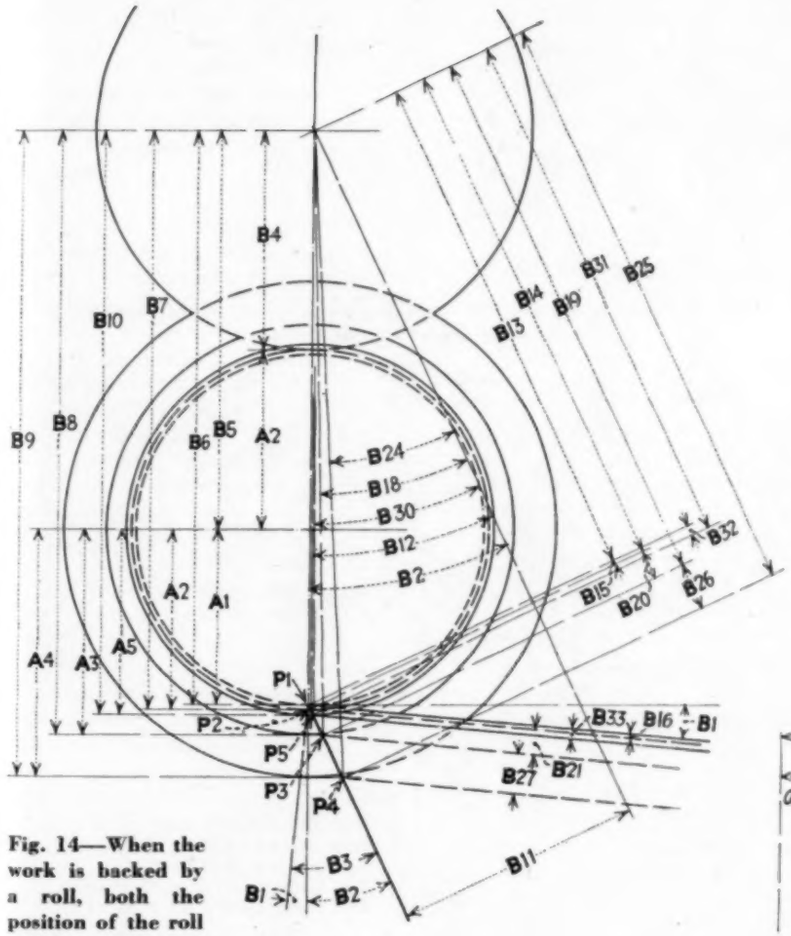


Fig. 14—When the work is backed by a roll, both the position of the roll and that of the tool must be considered in the layout

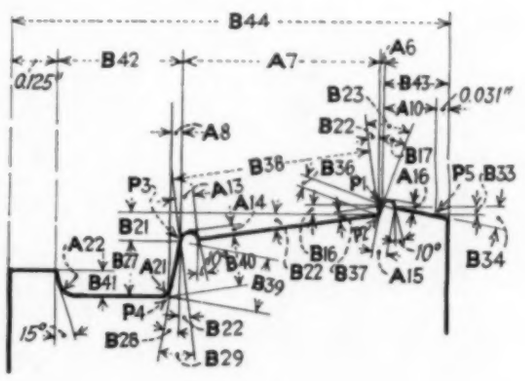


Fig. 15—Figured by Method 2, the tool contour dimensions will have values as indicated above

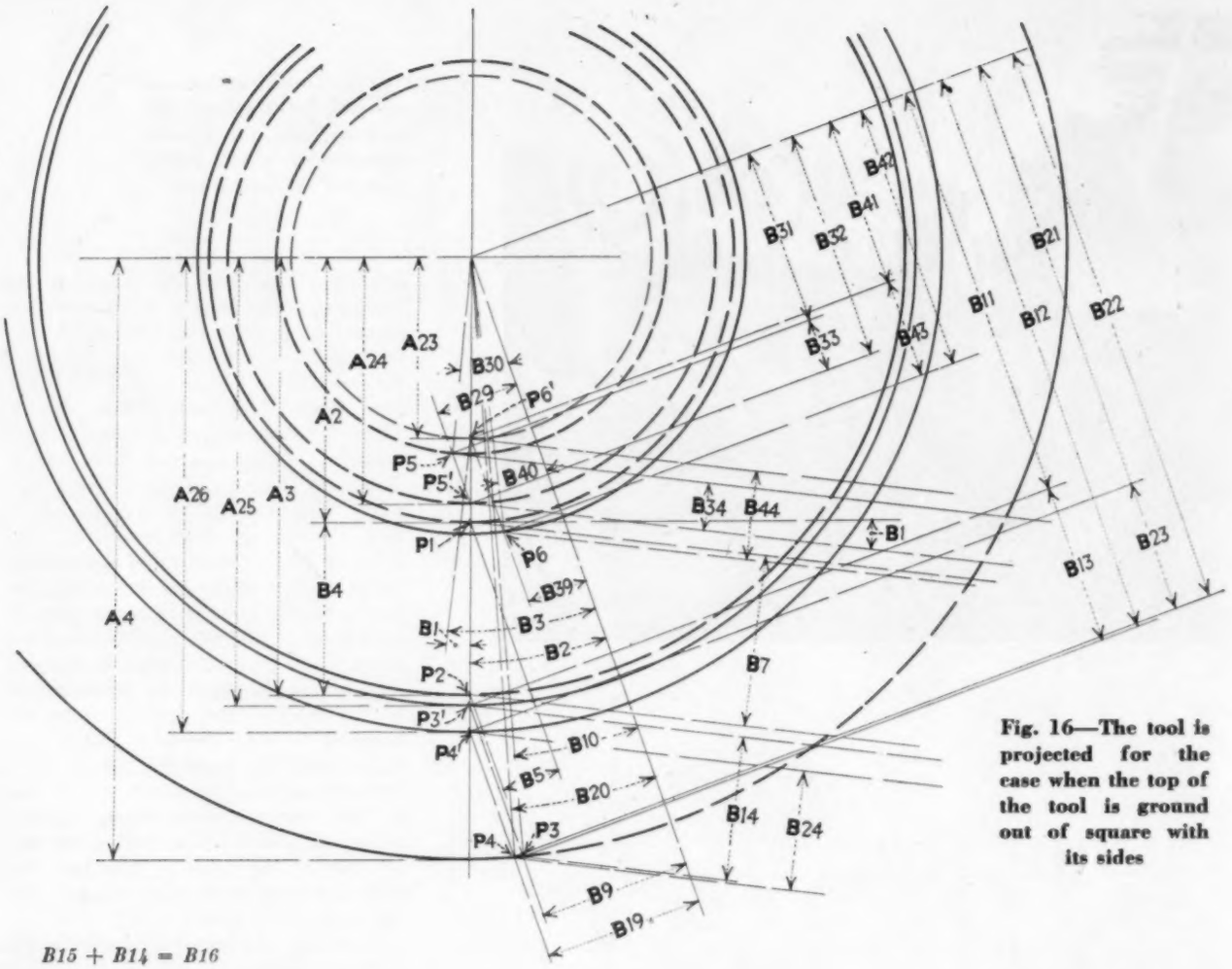


Fig. 16—The tool is projected for the case when the top of the tool is ground out of square with its sides

$B15 + B14 = B16$

$$\frac{A8}{B16} = \tan B17$$

$B17 + B8 = B18$

$A26 \times \sin B2 = B19$

$$\frac{B19}{A4} = \sin B20$$

$A26 \times \cos B2 = B21$

$A4 \times \cos B20 = B22$

$B22 - B21 = B23$

$B23 \times \cos B3 = B24$

$A9 \times \tan B8 = B25$

$B25 + B24 = B26$

$B26 - B14 = B27$

$$\frac{B27}{A9} = \tan B28$$

$A24 \times \sin B2 = B29$

$$\frac{B29}{A1} = \sin B30$$

$A1 \times \cos B30 = B31$

$A24 \times \cos B2 = B32$

$B32 - B31 = B33$

$B33 \times \cos B3 = B34$

$A6 \times \tan B8 = B35$

$B35 + B34 = B36$

$$\frac{A6}{B36} = \tan B37$$

$B37 + B8 = B38$

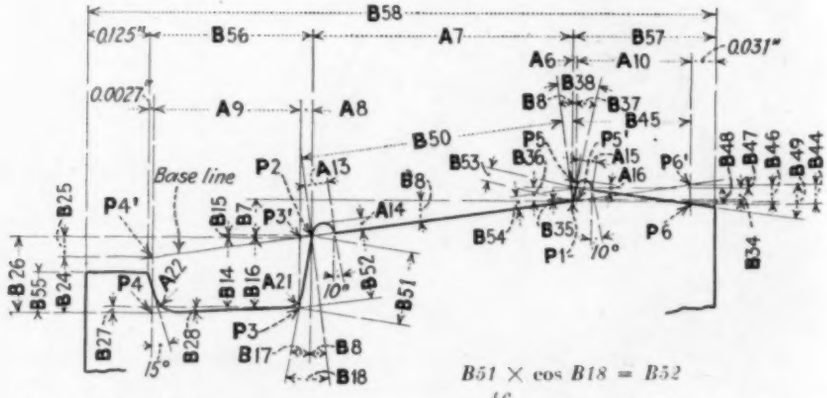
$A23 \times \sin B2 = B39$

$$\frac{B39}{A5} = \sin B40$$

$A23 \times \cos B2 = B41$

$A5 \times \cos B40 = B42$

Fig. 17—Connecting *P1* and *P2* is the base line which in this instance is kept on the center line of the work



$B42 - B41 = B43$

$B43 \times \cos B3 = B44$

$A10 + A6 = B45$

$B45 \times \tan B8 = B46$

$B46 - B36 = B47$

$B44 - B47 = B48$

$$\frac{B48}{A10} = \tan B49$$

$$\frac{A7}{\cos B8} = B50$$

$$\frac{A8}{\sin B17} = B51$$

$B51 \times \cos B18 = B52$

$$\frac{A6}{\sin B37} = B53$$

$B53 \times \cos B38 = B54$

$B55$ (same as $B32$ for Method 1)

$B56$ (same as $B33$ for Method 1)

$B57$ (same as $B34$ for Method 1)

$B58$ (same as $B35$ for Method 1)

In the solution of Methods 2 and 3, logarithms should be employed as advocated for Method 1. If each figure is calculated to five decimal places, the final working drawings will be accurate to four places.

Screw Thread Revisions Proposed

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Secretary, National Screw Thread Commission

Manufacturers and users of precision screw threads have generally found the Class 4 fit, as laid out by the N.S.T.C., to be impractical for the production of regular interchangeable threaded work. Especially is this true in the range of small sizes and finer pitches. On June 13, the commission decided to study this proposal for final action at its next meeting. Consequently, the tentative revision is of interest

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DIFFICULTIES in the way of producing Class 4 fits are two-fold: First, the component tolerances for this class are relatively small, and second, the gage tolerances for Class X gages are relatively large, although Class X gages have the closest tolerances so far specified by the commission. The result is that the gage tolerances may use so great a proportion of the component tolerances that there is little or nothing (in some cases less than nothing) left for permissible variation in the component.

It would appear that two remedies are open: first, an increase in the component tolerances; second, a decrease in the gage tolerances. Probably a combination of the two will be found most feasible.

It is also suggested that all machine screw sizes and all pitches finer than 28 threads per in. be eliminated from consideration under the Class 4 fit, as it is believed that these smaller sizes and finer pitches cannot be produced at the present time on a commercial interchangeable basis to closer tolerances than those of the Class 3 fit. In fact, it is doubtful if better than Class 2 is often obtained or required for threaded work in the machine screw sizes, except for special purposes where complete interchangeability is not expected.

Consideration of the pitch diameter tolerances for the various classes of fit as laid out by the commission shows that in general the P.D. tolerance for Class 2 is close to 70 per cent of that for Class 1 of corresponding pitch, and that the P.D. tolerance for Class 3 is close to 70 per cent of that for Class 2, but that the P.D. tolerance for Class 4 is only 50 per cent of that for Class 3. That is, on looking at the classification of fits as a complete system, the step between Class 3 and Class 4 is seen to be too large, or in other words, the Class 4 tolerances are too small to make up a complete and unified system of fits.

If the P.D. tolerances for Class 4 fit be made equal to 70 per cent of the Class 3 tolerances as Class 3 and Class 2 are each 70 per cent, respectively, of the next looser class, this will result in a new Class 4 fit that is believed possible of attainment with present high grade threading equipment, and one that will have a logical and useful place in the classification of fits.

A further step will be necessary, however, before even the revised Class 4 fit can be put into commercial production; that is, a suitable revision of Class X gage tolerances, or the setting up of a new class of gages with closer tolerances than those of Class X.

In the present state of the art of gage making, there is no necessity for the present relatively large lead and angle tolerances for Class X gages. The accompanying chart shows the extent to which lead and angle errors in the "go" gage encroach upon the component tolerance.

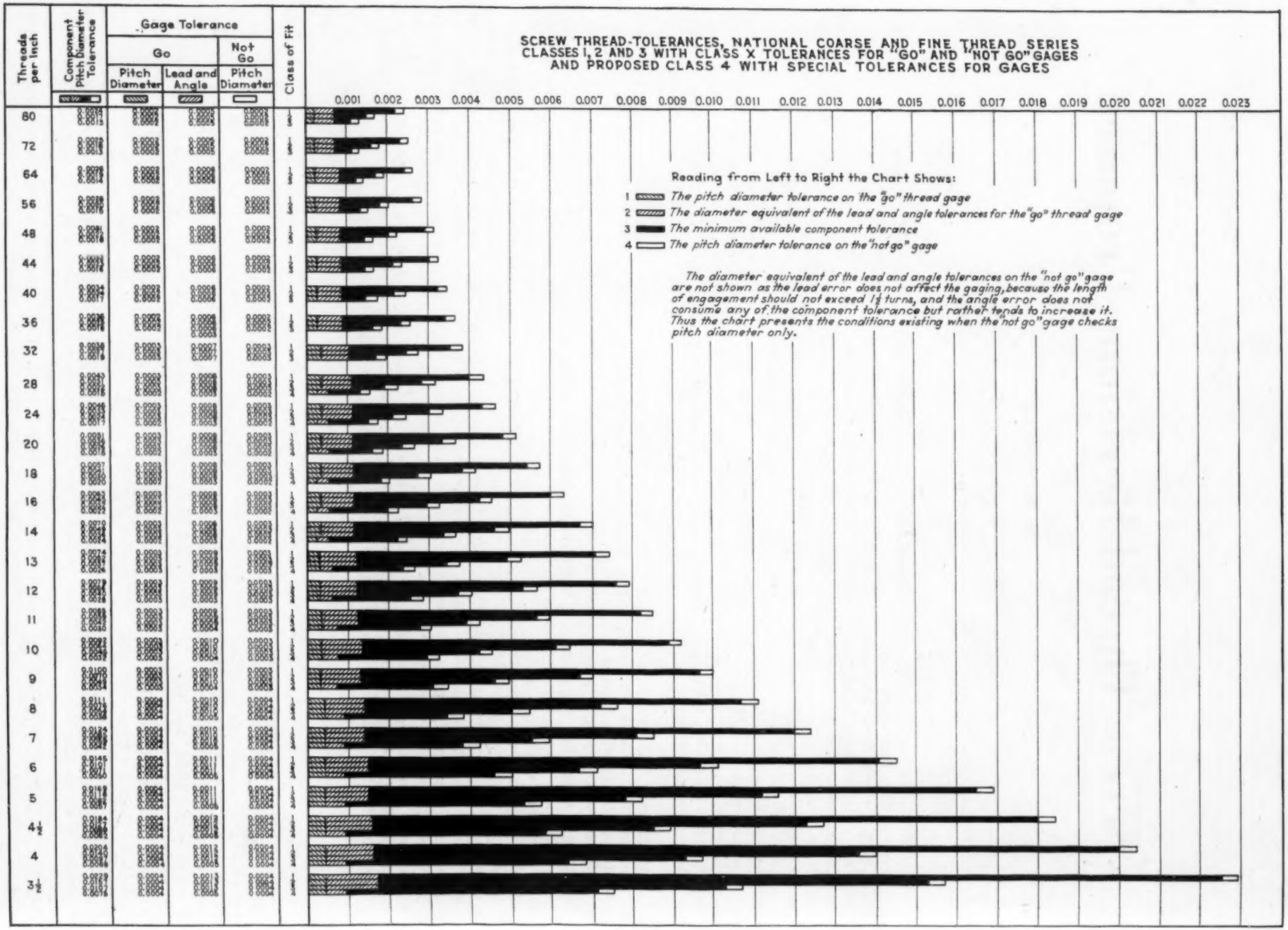
It is readily seen that the diameter equivalent of lead and angle errors, which must be added to the pitch diameter tolerance of the "go" gage, greatly exceeds the pitch diameter tolerance and is thus an important factor in reducing the effective tolerance that is available for use on the component. For example, a "go" plug gage made to the high limit on pitch diameter, and which, in addition, has the full error allowed in lead and angle, will not enter a threaded component of correct lead and angle unless the component is above the low component limit by at least the full amount of the gage P.D. tolerance plus the diameter equivalent of the lead and angle tolerance.

In the case of the "not go" gage, the lead and angle errors do not encroach upon the component tolerance, but act in the opposite direction, since the "not go" gage is required not to enter the component. The effect of lead and angle errors is to prevent the gage from entering a component that is correct in lead and angle.

In the following suggested set-up of gages for Class 4 fit, the pitch diameter tolerances for "go" and "not go" gages have been made as small as is thought commercially feasible. In pitches finer than 12 threads per inch, they are somewhat less than the N.S.T.C. Class X pitch diameter tolerances. For 12 threads per inch and coarser, the Class X P.D. tolerances are retained. The tolerances on lead and angle have been reduced on all pitches.

In establishing the tolerances on lead and angle, it has been assumed that the tolerance on lead should be half the tolerance on pitch diameter, and that the tolerance on angle should be that corresponding to half the tolerance on pitch diameter. These tolerances apply to

Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.


SCREW THREAD-TOLERANCES, NATIONAL COARSE AND FINE THREAD SERIES
CLASSES 1, 2 AND 3 WITH CLASS X TOLERANCES FOR "GO" AND "NOT GO" GAGES
AND PROPOSED CLASS 4 WITH SPECIAL TOLERANCES FOR GAGES
Threads per Inch
Component Pitch Diameter Tolerance
Gage Tolerance
Go
Pitch Diameter
Lead and Angle
Not Go
Pitch Diameter
Class of Fit
0.001 0.002 0.003 0.004 0.005 0.006 0.007 0.008 0.009 0.010 0.011 0.012 0.013 0.014 0.015 0.016 0.017 0.018 0.019 0.020 0.021 0.022 0.023
Reading from Left to Right the Chart Shows:
1 The pitch diameter tolerance on the "go" thread gage
2 The diameter equivalent of the lead and angle tolerances for the "go" thread gage
3 The minimum available component tolerance
4 The pitch diameter tolerance on the "not go" gage
The diameter equivalent of the lead and angle tolerances on the "not go" gage are not shown as the lead error does not affect the gaging, because the length of engagement should not exceed 1½ turns, and the angle error does not consume any of the component tolerance but rather tends to increase it. Thus the chart presents the conditions existing when the "not go" gage checks pitch diameter only.
80
72
64
56
48
44
40
36
32
28
24
20
18
16
14
13
12
11
10
9
8
7
6
5
4½
4
3½

Suggested Tolerances for Components and Gages for Class 4 Fit

Threads per in.	Component tol.	"Go" gage tol. P.D.	"Go" gage tol. Lead and Angle*	"Go" gage tol. Total	"Not go" gage tol.	Total "go" and "not go"	Min. net comp. tol.	N. S. T. C. 1928 Report M-89 for comparison Full comp. tol.	N. S. T. C. 1928 Report M-89 for comparison Net comp. tol.
28	0.0015	0.0002	0.0003	0.0005	0.0002	0.0007	0.0008	0.0011	—0.0003
24	0.0017	0.0002	0.0003	0.0005	0.0002	0.0007	0.0010	0.0012	—0.0003
20	0.0018	0.0002	0.0003	0.0005	0.0002	0.0007	0.0011	0.0013	—0.0002
18	0.0020	0.0002	0.0003	0.0005	0.0002	0.0007	0.0013	0.0015	0.0001
16	0.0022	0.0002	0.0003	0.0005	0.0002	0.0007	0.0015	0.0016	0.0002
14	0.0024	0.0002	0.0003	0.0005	0.0002	0.0007	0.0017	0.0018	0.0003
13	0.0026	0.0003	0.0003	0.0006	0.0003	0.0009	0.0017	0.0019	0.0004
12	0.0028	0.0003	0.0003	0.0006	0.0003	0.0009	0.0019	0.0020	0.0005
11	0.0030	0.0003	0.0004	0.0007	0.0003	0.0010	0.0020	0.0021	0.0006
10	0.0032	0.0003	0.0004	0.0007	0.0003	0.0010	0.0022	0.0023	0.0007
9	0.0034	0.0003	0.0004	0.0007	0.0003	0.0010	0.0024	0.0024	0.0008
8	0.0038	0.0004	0.0005	0.0009	0.0004	0.0013	0.0025	0.0027	0.0009
7	0.0042	0.0004	0.0005	0.0009	0.0004	0.0013	0.0029	0.0030	0.0012
6	0.0050	0.0004	0.0005	0.0009	0.0004	0.0013	0.0037	0.0036	0.0017
5	0.0057	0.0004	0.0005	0.0009	0.0004	0.0013	0.0044	0.0041	0.0022
4½	0.0062	0.0004	0.0005	0.0009	0.0004	0.0013	0.0049	0.0044	0.0024
4	0.0068	0.0004	0.0005	0.0009	0.0004	0.0013	0.0055	0.0048	0.0027
3½	0.0075	0.0004	0.0005	0.0009	0.0004	0.0013	0.0062	0.0053	0.0032

*The amount that may be taken from the pitch diameter tolerance of the component as the result of lead and angle errors in the "go" gage. This is calculated on the basis that the lead may be in error by ½ the P.D. tolerance and that the angle error may be such that the equivalent error in P.D. may be ½ the P.D. error. That is, the error in P.D. from the combined lead and angle errors may be 1.7x½ P.D. tolerance + ½ P.D. tolerance.

both "go" and "not go" gages, though, as already pointed out, the errors in lead and angle of the "not go" gages tend to accept parts rather than to reject them.

On the above basis, it is evident that the amount by which the tolerances on the "go" gage may reduce the component tolerance will be the sum of the pitch diameter tolerance plus 1.7 times the lead tolerance plus ½ the pitch diameter tolerance. The accompanying table is calculated on that basis.

In revising the Class 4 fit, consideration should also be given to two other possibilities. The first is that of reducing the maximum pitch diameter of Class 4 screws to basic to agree with Classes 2 and 3. There has always been some criticism of the Class 4 fit on the ground that the limiting sizes of the maximum screw and minimum nut are such that an interference fit is theoretically possible.

In this connection, however, it must be kept in mind that if the screws and nuts are both gaged with "go" gages having tolerance and wear allowance correctly placed with reference to the product limits, the maximum screw accepted by the "go" ring gage will actually be below the theoretical maximum by the amount of the tolerance and wear allowance on the gage, and similarly the minimum nut will be larger than the theoretical minimum size by the amount of the tolerance and wear allowance on the "go" plug gage. In general, therefore, a screw as close to the theoretical maximum size as will be accepted by the "go" ring gage will not be excessively tight when mated with a nut that is as small as will be passed by an acceptable "go" plug gage. That being true it is held by some that the maximum screw size for Class 4 fit should be slightly above basic, as it now is in the 1928 report of the N.S.T.C. The matter will be fully discussed at the next meeting of the commission.

The second point mentioned above, which should receive consideration, is the possibility of eliminating the present inconsistency in the pitch diameter tolerance for bolts and nuts of 10 and 8 threads per inch, fine thread series, as compared with the same pitches in the coarse thread series. Tolerances for the 10 and 8 pitch fine thread series, as given in the 1928 report, are based on threads per inch, diameter and length of engagement, whereas for all other pitches in both the coarse and fine thread series, the tolerance is based on threads per inch only. The result is that the 10 and 18 pitch fine series threads have excessively large tolerances, as compared with all other threads of the regular series.

There appears to be no necessity for this exception in the regular series for bolts and nuts. The reason the exception was originally made was to bring the tolerances for these pitches, which in the fine thread series apply to diameters from 1¾ to 3 in., into line with the table for threads of special diameters, pitches and lengths of engagement (Tables 26 to 31, 1928 report). It now appears more important to have a system of tolerances that is consistent for all pitches of the regular coarse and fine thread series, than to sacrifice this consistency in an attempt to harmonize the tolerances for the regular series with those for the special threads. The special series of threads is intended for special purposes such as hub caps, radiator caps and threaded collars. These threads are usually of relatively large diameter and short length of engagement, and the question of whether or not the tolerances for these special threads are consistent with those for the regular bolt and nut series is not particularly important.

A further point in regard to the fine thread series above 1½ in. diameter is the fact that there is now lack of agreement between the N.S.T.C. standard and the S.A.E. standard in this size range. Efforts are underway to bring about agreement between the N.S.T.C. and the S.A.E. screw threads committee in this size range, and in this process of arriving at a uniform standard, the question of tolerances for 10 and 8 pitch threads might well be given further consideration. This consideration will involve not only the Class 4 fit, but Classes 1, 2, and 3 as well.

In the accompanying chart, the matter has been handled by eliminating the two exceptions, 10 and 8 pitch fine thread series, and following the uniform practice of basing pitch diameter tolerance on threads per inch only throughout both series.

The gage tolerances suggested above are tentative only. In final form, the tolerances on P.D. lead and angle, for both "go" and "not go" gages, will be expressed separately.

Wastes That Cost Money

GEORGE WINTRITZ

Strength of material apparently plays but a small part in the design of many tools and fixtures, as well as in more pretentious machines. Waste from this source is a much larger item than many imagine. Among the instances seen recently were:

A ¼-hp. motor used where a 1/40-hp. would easily do the work.

A machine with a ⅛-in. hp. motor and a shaft made of a ¾-in. drill rod. This shaft could transmit 5 hp. at 500 r.p.m.

A ¾-in. push rod used when a ⅛-in. pull rod would do the work.

A part in a production machine broke and the replacement was held by screws of only one-quarter the area of the original. As it had been well designed, the replacement failed to hold and caused another delay.

Much waste would be avoided by insisting that anyone who specifies sizes be familiar with the fundamentals of material strengths when subjected to tensile, shear, bending and compression stresses.

Management Uses A Common Denominator

JOHN HAYDOCK
Associate Editor

Diversified plant functions are correlated by plan to effect closer production control and operating economies. The figures and charts given are authentic, but the company supplying them prefers not to disclose its identity

ABOUT the middle of 1931, a certain manufacturing plant was working quietly at somewhat below its normal capacity. The flow of work had been practically uniform since the first of the year, and although several large quotations were outstanding, no sudden fluctuations in the production schedule seemed imminent.

Then came the information that an unusually large order had been received. A delivery of six weeks was of prime importance, making it imperative to utilize each day to its fullest advantage. It was apparent that certain operations would have to be speeded up and more men added to the force. It meant doubling the rate of production in several departments.

But as yet the final order had not reached the plant, and the material had not been prepared. Despite these handicaps, no time was lost in getting into action. New men were taken on at once and the working hours were lengthened where necessary. Plant capacity was quickly stepped up to the exact pitch needed to handle the anticipated increase in work. All of this was accomplished before actual receipt of the written order.

When the order reached the plant, the old work was well out of the way and the operating departments were ready to expedite the new work. The promised delivery was met, and the whole job was handled with little disturbance to manufacturing routine. In short, the flurry and confusion, which often accompanies unexpected loads in a plant, were avoided by careful planning.

This particular incident is typical of many which this plant has met by a definite method of control, devised to handle the many phases of shop management. It is the purpose of this article to tell how it was done.

Some production systems work well in a plant with a uniform product and a normal output. But when subjected to the vicissitudes of product diversity and fluctuating loads on plant capacity, they break down. The quality of flexibility that enables a plant to meet unusual conditions is highly important, for it is when there are deviations from the normal that systematic planning is most needed. To be really effective, a thoroughgoing system should readily adjust itself to unusual conditions, and in addition, aid management in anticipating them.

The method used by the plant in question has demonstrated that it is adaptable to change. It has gone through the years of peak production and those of subnormal output. The company uses a wide range of manufacturing processes and raw materials.

The principle employed is to reduce plant activities to one common denominator. The Dyer system is followed, which uses as a basis of measurement one "unit," or the normal output of one man in one minute. Normal production is rated as 60 units per hour. If an operator exceeds this mark over a daily period, he is paid a premium.

But from the incident cited it may be seen that the "unit" system does far more than provide a basis for the incentive plan. It provides a common language for all plant functions. A machine takes so many units to build; an operating department has so many units capacity; an operator turns out so many units per day; the production department records so many units completed on a given order; the cost department uses units as a basis for standard costs.

Although the application of a common denominator is simple, its advantages are important. Where formerly one department thought in terms of hours, another in dollars, another in parts produced, another in assemblies, each now has the same basis upon which to work. Since it is possible to coordinate the varied manufacturing functions without laborious transpositions from one terminology to another, the problems of management are greatly reduced.

But let us consider specifically how

Unit Requirements to Produce Articles Scheduled in Operating Department

Article	Units Each	Weekly requirements	Productive unit requirements
A	660	15	9,900
B	564	2	1,128
C	110	1	110
D	360	26	9,350
E	140	34	4,760
F	150	2	30
G	174	2	348
H	50	25	1,250
J	58	1	58
K	245	2	490
L	415	8	3,320
M	380	8	3,040
O	203	8	1,624
P	217	15	3,250
Q	89	20	1,780
R	90	6	540
S	230	6	1,380
T	86	2	172
U	53	2	106
			42,906
		Plus 6% day work.....	2,574
		Total.....	45,480

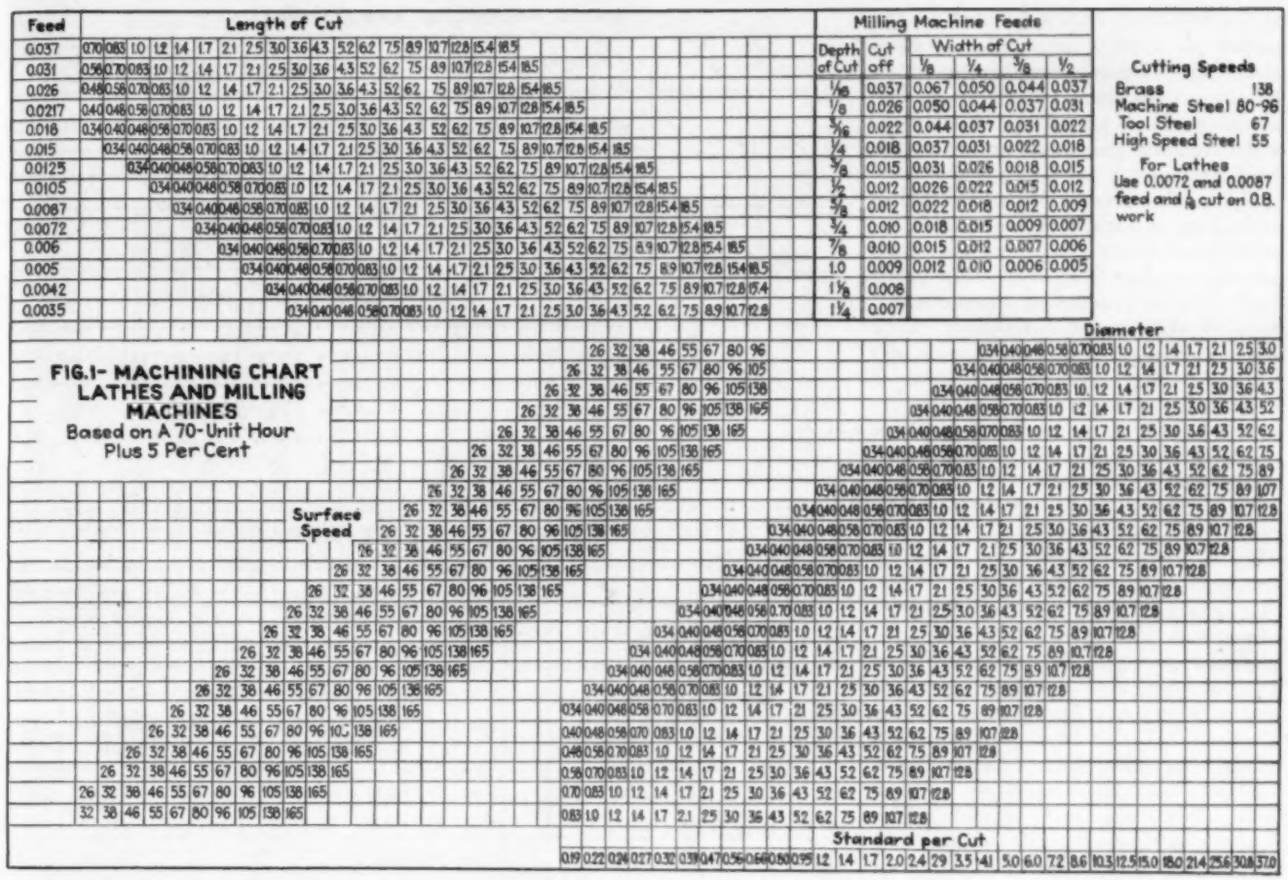


FIG. 1— MACHINING CHART LATHES AND MILLING MACHINES
Based on A 70-Unit Hour Plus 5 Per Cent

the use of a common denominator affects volume production control. This term is distinguished from detail production control which governs the scheduling of work through the operating departments. Volume production means the major fluctuations which good management endeavors to anticipate.

When an order is received, the items involved are translated into "units," broken down by departments. For instance, Assembly A, the first item listed, takes 660 units in the Department X. Since fifteen of these assemblies must be turned out weekly, the load in the department from this one item is 9,900 units. All other items are similarly evaluated until the entire scheduled load is determined. To the sum thus obtained is added 6 per cent, which experience has shown to be the average unmeasured day work handled by the department, making a total of 45,480 units. A 48-hour week contains 2,880 units per operator, assuming that the department production average is equivalent to a 60-unit hour. With a 70-unit hour performance, each operator will turn out 3,360 units, and with an 80-unit hour performance, 3,840 units. Di-

Calculation:
2880 units per week
at 60 units per hour

Working 70-unit hour:

$$\frac{45480 \times 60}{2880 \times 70} = 13.5 \text{ operators per week}$$

Working 60-unit hour — 16 operators per week.

Working 80-unit hour — 12 operators per week.

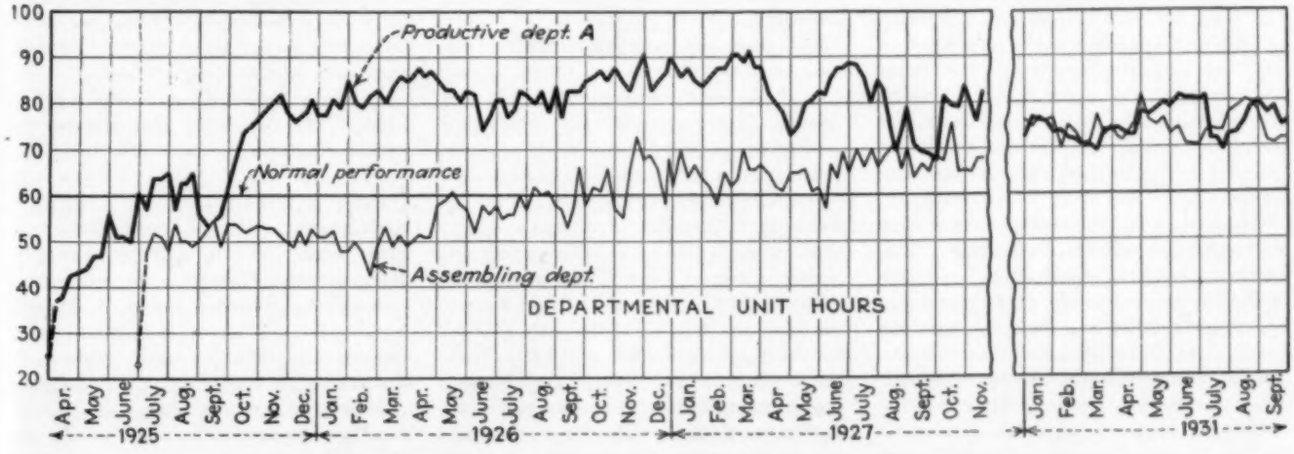


Fig. 2—Increased efficiency is attributed to the "unit" yardstick

viding the total units scheduled by the output per worker, the number of operators required may be readily computed for the various degrees of efficiency. The actual performance of the department will determine the unit-hour rate to be used.

When the production manager has arrived at the required man-power for each department, he may at once start gearing the plant to meet the anticipated load. When production schedules are reduced, the process is reversed. It is not necessary to wait until certain departments have practically run out of work before reducing the force or hours of operation. A quarterly forecast of the articles to be manufactured is drawn up and revised monthly.

Much of the success of the plan depends on properly evaluating the unit. This is done by time study and by standard time charts. Overall time-studies are of little value until broken down into their elements. Then the known factors may be segregated from the unknown, and valuable conclusions reached, especially in regard to setting-up times. These data, combined with computed machine time tables, form an effective basis of rate setting.

Fig. 1 is given as an example. This is a machining chart for lathes and milling machines based on a 70-unit hour plus five per cent. Thus a man performing work above the standard 60-unit hour basis has an opportunity to earn a premium.

Estimates by Chart

Assume that a 2½ in. shaft of machine steel is to be turned for a length of 9 in. Selecting a feed of 0.026 in. per revolution, we locate this figure in the left hand column of Fig. 1. On the same line horizontally, we find a value of 8.9 in. under length of cut which is the figure nearest the length required. Vertically below this, we mark another square at the speed to be used, say in this instance, 80 ft. per min. Tracing a line horizontally to the diameter of 2½ in. and downward to the lower scale, we find the result to be 3.5 units. This is the rate for a single cut. It must of course be multiplied by the number of cuts and the set-up time added.

From such basic data, the total time for each operation is built up. This method assures consistent valuation definitely related to the elements of machine and hand time. It is felt that the results are more accurate than a time-study of each operation. Such a procedure would be costly because of the widely diversified operations carried on in this plant. The men engaged in setting standards are selected because of their shop experience or their familiarity with shop practice. No method of utilizing this information has been devised that removes the need of sound judgment.

Estimates on new work follow the same general procedure. Often a proposal includes a number of entirely new designs. Because of the analytical method employed, their cost may be predetermined with surprising accuracy.

Another highly important phase of the plan is its effect on costs. Fig. 2 gives some average weekly production performances. Two departments are shown from the time of the inception of the plan in 1925 to 1931, with a break for the years 1928, 1929 and 1930. These years were omitted because they contain only normal fluctuations and add nothing to the picture. The heavy line represents Operating Department A while the light line represents the Assembly Department. On each curve, the first point designates the week prior to starting the system. Referring to Fig. 3, it will be seen that these points are 25 and 21 units respectively. That means for Operating Department A on an average, each man was turning out only 25 units as against a standard of 60 units of work. The Assembly Department was even less efficient.

The first week under the new plan showed a remarkable improvement in performance. Gains continued week after week, until in a little more than three months, Operating Department A crossed the standard mark of 60 units an hour. In seven months, it had crossed the 80-unit mark where with fluctuations it has remained ever since.

Improvement was slower in the Assembly Department. The curve rose gradually but took about sixteen months to get safely above the 60-unit standard.

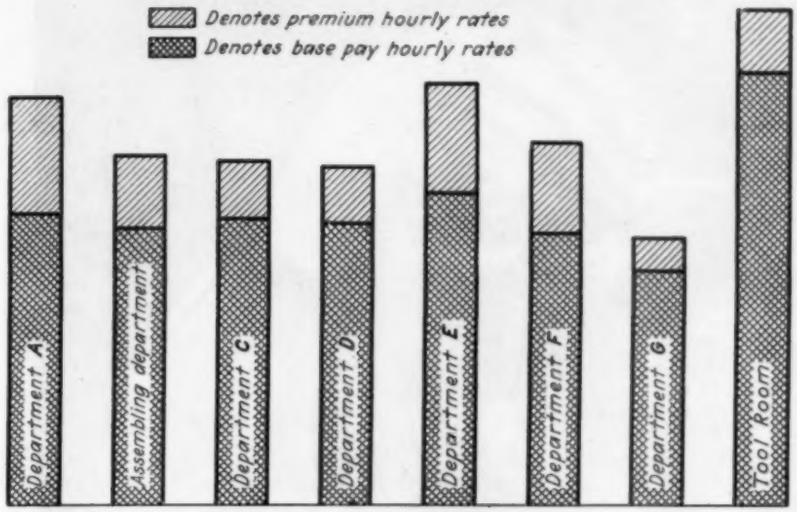
UNITS PRODUCED AND PAYROLL

	DATE	OPERATORS	PRODUCTION UNITS	PAYROLL	OPERATORS EARNINGS			SUPERVISORS PREMIUM WEEKLY
					HOURLY	PREMIUM	TOTAL	
PRODUCTIVE DEPARTMENT A	April 1925	22	32,718	602.29	0.52	0.00	0.52	0.00
	April 1926	10	32,984	392.50	0.56	0.18	0.74	10.08
ASSEMBLING DEPARTMENT	July 1925	42	49,408	898.91	0.51	0.00	0.51	0.00
	Dec. 1927	19	49,567	589.99	0.50	0.08	0.58	6.72
TOOL ROOM	June 1930	30	37,330	1,238.94	0.78	0.01	0.79	0.00
	Feb. 1931	22	39,441	974.93	0.83	0.12	0.95	5.80

POSTING SHEET – PRODUCTIVE DEPARTMENT "A"

			Date 4/27/25 Day MONDAY					Date 4/5/26 Day MONDAY				
Employee No.	NAME	Unit Rate	Total Time Worked	WORK ON STANDARD				Total Time Worked	WORK ON STANDARD			
				Min.	Units	Units Per Hour	Prem.		Min.	Units	Units Per Hour	Prem.
	H. L. JACOBS		530	505	610	72	.74	525	410	625	91	2.03
	W. CROLL		530	515	302	35		530	450	680	91	1.61
	T. A. ADAMS		530	520	363	42		560	195	248	76	.40
	R. D. MOORE		530	515	270	31		545	500	833	100	3.15
	H. FAULKNER		530	60	76	76	.14	530	525	443	51	
	G. SMITH		530	500	360	43		530	530	763	86	2.55
	B. D. SPALDING		530	420	179	25		525	445	529	71	.77
	C. IVINS		530	530	370	42		530	505	711	84	1.44
	L. B. HEALY		530	500	282	34		530	500	744	89	1.81
	W. SAUNDERS		530	500	401	48		530	525	609	70	.59
	TOTAL		5300	4585	3713	42	.88	5335	4585	6185	81	14.35

Fig. 3—Ratio of Premium Rates to Base Rates



A review of the first two years' results would lead most observers to conclude that the rates for the Assembly Department had been set much tighter than those for Operating Department A. But the 1931 performance disproves this.

There is a definite reason for the difference in slope of these curves. Production Department A included standard operations in an advanced stage of development. The gain in efficiency resulted largely from increased output by the operators. Thus the potential gains were realized relatively quickly when incentive was provided. The increased production in the Assembly Department resulted partly from speeding up on the part of the operators and partly from educating the force in the methods upon which the standards were based. This achievement took more time, but the ultimate result was practically the same as for Operating Department A.

Far-reaching advances, such as this, have dispelled the fear expressed in some quarters that the setting of standards would tend to freeze old practices of operation and to retard the introduction of entirely new practices. As in the example given, standards are often based on methods in advance of those actually in use. When a still newer method is introduced, the standard must of course be revised.

Output Increased

The two departments represented by the chart are typical of the others to which Dyer standards have been applied. Assuming that the old procedure resulted in an average of 25-unit hours and the present in 75-unit hours, the output for each department has been approximately tripled.

Had the plant continued to operate on the old basis, it would have been necessary to increase its capacity greatly during the peak year 1929. A tremendous burden of overhead would thus have been built up.

In times of subnormal production, there is always a tendency for operators to slow down. The present control checks this tendency through the incentive for the operators to maintain standards of performance and through its influence on the supervisors who also share in the incentive.

The tabulated figures vividly illustrate the advantages of the system to both the company and the employee. Here are given the performances of three departments entirely different in function. For each, two weekly periods were selected, during which the output was practically identical. In every instance for the same production, the number of operators was decreased, the payroll was reduced, and the earnings per operator were raised considerably. In addition, the department supervisors received extra remuneration.

Of special interest is the toolroom. Many plants find incentive plans successful for their operating departments handling repetitive work. Those in charge hesitate to extend their methods to departments where this condition does not prevail. Like most others, this company's toolroom works largely on one-time jobs. Despite this, the plan employed yields economies here as in other departments. This success is largely dependent on the method of rate setting.

To break down the analysis still further, the workmen's record is given for one department taken on two days about one year apart. The first list indicates that only two men earned a premium, while the second indicates that all but one man exceeded the standard. The names given are fictitious and do not in every instance refer to the same man for both days, but they do represent all the men in the section.

One more illustration will be given to demonstrate the advantage to the operator. Fig. 3 shows the premiums earned by the men in several departments as compared to the total base pay rate. In each department there has been a decided addition to the men's earnings.

With so much written and said today about technological adjustment, some readers may wonder as to the effect on employment of these striking economies in plant operation. It is obvious that no company can deliberately countenance high costs and wasteful methods and expect to remain in business. But even were this possible would the results be beneficial? Decidedly not. The enormous burden of overcapacity is a vital problem in many industries today. If this plant had not by sound management avoided unnecessary expansion, it would have hurt itself and the industry it serves. Users of its product would be compelled to pay higher prices. Its employees would necessarily receive greatly reduced wages. Inefficiency can never be justified.

The reduction in payroll does not mean that a proportionate number of men have been laid off. Back in 1926, when other industries were capable of absorbing excess labor, it was logical to release some of the force. But today, a well planned stagger system is used to keep the men employed. A weekly schedule is drawn up showing that on specified days certain employees shall not report for work. Key men are alternated so as to avoid interruption to production. The result is a shorter week. The solution in this plant is more men at shorter hours. Certainly this is better than tolerating wasteful methods.

A Plastic Pattern for a Crankcase Patch—*Discussion*

WM. BRYCE
Sheffield, England

The method of patching described by H. M. Price in an article under the title given above (*AM*—Vol. 76, page 847) is good, but is rather a long process.

Instead of plastic material, I use sheet lead of the necessary thickness and hammer it lightly to the surface around the fracture. It thus becomes bedded to the required contour and can be used as a pattern for casting the patch in brass or other metal. After the casting has been cleaned, it is fastened in place by screws, using some form of gasket if necessary. If the patch shows, it does not matter much as a rule.

Courtesy Worthington Pump & Machinery Corporation *Photo by Rittase*

Parts right the first time

exemplify the rout of cut-and-try methods by precision tools

EDITORIALS

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K. H. CONDIT F. H. COLVIN
EDITORS

A Major Selling Job

Industry and industrial executives are on trial, as we pointed out in the *American Machinist* for August 3. And tribulation is added to the trial by the refusal of the Federal Reserve Board to depart from the well-established tradition that loans for any kind of machinery are no concern of a commercial bank.

But a crucial test lies before the builders of such self-liquidating equipment. They are facing one of the biggest selling jobs of history. Not only are they up against the task of selling the modernization idea to their customers, they have first to sell it to themselves.

Is this too harsh an indictment? Hardly. How many textile machinery builders have set out deliberately to sell looms and spinning frames to weavers and spinners with shops full of antiquated, foundry-built machinery on the basis of what the modern equipment will save them? Very few.

What printing press builders of your acquaintance have gone into printing plants armed with the facts and figures to prove how expensive old presses can be? Not many.

And how few machine-tool builders have backed up their acceptance of the slogan that it pays to modernize by carefully planned sales and advertising campaigns. These few have done an outstanding job and they have profited thereby.

If our criticism is unjustified, how is it that we find so many railroad shop superintendents who are pretty well satisfied with tools that came out of the ark? Why are most of the automobile plants getting along with equipment that is making production costs twice what they ought to be? If their costs are high, think what the costs in other metal-working plants are!

And why is it that machinery users say that they know what machines they are going to buy, "when times get better," and that they have the money to buy them, as every one knows, yet no orders are placed?

There is only one answer: the modernization idea has not been sold. Some machine tool builders, *American Machinist*, and a few score progressive production executives have taken the matter seriously and have made some headway, but they need the cooperation of the whole machinery industry. Unless the idea is sold—vigorously, courageously and with conviction behind the selling—all the loans in creation will not move a machine from warehouse or assembly floor to the shop that needs it.

Frankness Helps Maintain Morale

Next to remaining solvent and carrying on, no management problem is more important than that of maintaining the morale of the whole organization. In justice to managers as a group, it is but fair to say that they have tried to protect their men in every way possible ever since the depression began. Now that wage reductions have become inevitable in most cases, it is even more difficult to maintain the morale which is so necessary, both for the present and the future.

Those who are most successful in maintaining morale, and the friendly relations that go with it, have adopted the progressive attitude of taking their employees into their confidence to the fullest extent possible. Instead of announcing wage adjustments in a printed circular with no explanations, high officials are making personal contact with employees, usually in groups, wherever it can be done, and giving facts and figures concerning the business status, with a frankness that was unheard of a few years ago. With such a background it is easy for employees to realize that their employers are as much victims of conditions as themselves, and every worthwhile man in the plant puts his shoulder to the wheel to help out.

Frankness as to conditions, together with the assurance that wages or salaries will be advanced as soon as conditions warrant, will do much to maintain morale in spite of the present stress. Such morale will be of great value in keeping production costs at the lowest possible point and make for better relations in the days that lie ahead.

Guaranteed Monthly Incomes

Violent fluctuations of any kind are unhealthy whether in the stock market, dividends, wages or production. As James D. Mooney, President of General Motors Export Company, said in his paper at the Bigwin meeting of the A.S.M.E., "Purchasing capacity, unfortunately, has been identified and dramatized as a function of daily-wage rates, rather than as a function of the worker's annual earnings and the cost of living. Industry must be free to shift wage rates up or down to suit varying conditions. Industry, on the other hand, must face its responsibility of providing greater economic security for its loyal members."

These are but samples of the many points in the paper that afford food for thought for management. Cost of production in terms of direct labor, overhead and materials is only part of the problem. Distribution, not only of product but of what Mr. Filene happily

designates as "purchasing power," is much more important, largely because we have developed production intensively without paying much attention to the latter. If one doubts that this is a problem for management he should read all of Mr. Mooney's paper with great care.

The same thoughts are behind the employment plan recently adopted by the Delaware & Hudson railroad. Realizing that the monthly or yearly income is far more important than a high daily rate without security, the new plan guarantees two hundred and forty hours pay per month to regular employees and one hundred and sixty hours per month to extra men. It includes all of the Big Four railroad brotherhoods, and is to be tried for a year.

No overtime is to be paid. A man may work up to twelve hours' straight time but no one is to work over two hundred and forty hours a month. Each regular man receives pay for two hundred and forty hours even if he works less. He cannot work more.

It is quite probable that a year's experience will suggest minor changes in the plan. Conditions can readily be imagined where temporary modifications as to hours might be advisable. But with both management and men broad enough to agree to such a plan there should be no trouble in smoothing out small difficulties as they arise. The successful operation of such a plan by an organization of this size will do much to convert others to the principles involved.

CHIPS

Improvements in security and commodity prices overshadow discouraging statistics of industrial activity . . . reflect improved sentiment . . . react to improve sentiment, particularly among Republican politicians and officeholders . . . Best ground for optimistic view of future lies in absence of major threats to confidence, at home and abroad.

Federal Reserve Board refuses to recognize Glass Amendment authorization of long-term loans . . . limits loans to 90 days and bars loans for machinery or other capital goods . . . Generally believed that formation of a Commodity Finance Corporation is imminent . . . Apparently it is considered safer to gamble in raw materials than to invest in self-liquidating equipment . . . Railroad chiefs not much interested in R.F.C. offer to finance replacements and repair . . . especially at 5 per cent . . . Scrap Iron group asks $15,000,000 to finance scrap deals.

Mussolini musses up his cabinet . . . looks askance at the League . . . Chinese cabinet resigns . . . floods kill thousands, damage crops around Harbin . . . Japan annoyed at Stimson intimation that she might have been aggressor in Manchuria . . . South American fighting ceases, temporarily at least . . . Germany disturbed by thoughts of what a Hitler-Junker cabinet might do.

Pennsylvania releases 7,000 tons of steel for Newark improvements . . . pushes electrification of New York division . . . Richardson & Boynton stove plant reopens with 200 men . . . Mullins Manufacturing adds 50 men and announces release of $700,000 orders . . . Ritter Dental Manufacturing expects to be running full time by October 1 . . . Illinois and Republic Steel plants reopened . . . White Truck starts on million-dollar truck order for U. S. . . . 400 men go back at shops of Gulf, Mobile & Northern.

Unseasonal rise in engineering construction encouraging . . . effect will be increased by Relief Bill construction very shortly . . . development of zinc-coated rivet may lead to change in construction methods . . . opens way for galvanized steel members joined by rustproof rivets . . . Chromium plating decision expected to have far-reaching effects . . . Standard of N. J. opens hydrogenation plant to inspection . . . includes largest alloy steel forgings in the world . . . Successful development of plan is proof that an industry can share a patented process without leaving all the profits for the lawyers.

Long Island R.R. displays double-deck passenger car for commuters . . . will experiment with it . . . if successful may mark important change in transportation practice . . . Bus business off only 12 per cent from 1931 . . . 2,000 more buses on the roads . . . Formation of General Air Express will facilitate air shipments . . . should help in dispatch of emergency repair parts for machinery . . . Electrical energy curve turns down after several weeks' rise . . . Promising experiments made in house heating by reversed refrigeration . . . Chicago engineer proposes 2,000-ft. steel observation tower for World's Fair . . . to be equipped with 1,600-ft. per min. elevators . . . In Holland a sodium vapor lamp with high illuminating power is perfected . . . would be useful in shops for close inspection where monochromatic light is valuable . . . Resumption in textiles no more than seasonal so far . . . Food industry being approached by British promoters who are urging establishment of branch plants in Canada, the products of which they will sell in England . . . indicates general belief that Ottawa Conference will be successful in making closed trading group of British Commonwealth.

Roy D. Chapin, automotive leader, succeeds Robert P. Lamont as Secretary of Commerce . . . Lamont becomes president of American Iron & Steel Institute . . . will work with Chairman Schwab to increase scope of Institute.

Exports of Metal-Working Machinery During June, 1932

	June, 1932	May, 1932	June, 1931
Engine lathes	$61,185	$15,083	$312,645
Turret lathes	4,750	2,700	93,180
Other lathes	5,688	15,484	125,295
Vertical boring mills and chucking machines	102,562	27,740	70,584
Thread-cutting and automatic screw machines	12,001	1,519	123,708
Knee and column type milling machines	30,083	28,757	81,609
Other milling machines	9,470	22,099	438,890
Gear-cutting machines	29,526	23,115	295,540
Vertical drilling machines	3,474	3,613	132,057
Radial drilling machines	7,028	250	57,521
Other drilling machines	7,837	34,970	376,416
Planers and shapers	30,350	34,075	76,577
Surface grinding machines	2,611	1,920	110,872
External cylindrical grinding machines	12,386	34,994	263,329
Internal grinding machines	26,840	3,352	128,234
Tool-grinding, cutter-grinding, and universal grinding machines	28,865	10,072	80,458
Other metal-grinding machines	38,085	22,439	188,018
Sheet and plate metal-working machines	151,124	158,862	289,704
Forging machinery	86,707	114,196	490,658
Rolling mill machinery	13,758	4,476	47,808
Foundry and molding equipment	51,367	12,819	649,387
Other power-driven metal-working machinery and parts	118,665	185,228	433,069
Related Exports			
Pneumatic portable tools	$35,335	$21,033	$33,098
Other portable and hand or foot operated metal-working machines and parts	21,275	97,419	51,430
Chucks for machine tools	3,141	2,553	12,089
Machine-operated pipe and thread cutters, stocks, dies, taps, and other machine-operated cutting tools	87,300	47,763	195,055
Other metal-working machine tools	16,367	18,844	126,225

Exports of Machinery During January-June, 1932

	June, 1932	May, 1932	June, 1931
Electrical machinery	$3,438,157	$3,771,051	$7,375,098
Power-generating machinery, except electric and automotive	314,593	816,266	1,116,710
Construction and conveying machinery	325,793	635,138	1,976,220
Mining, well, and pumping machinery	792,906	895,907	2,409,129
Powder-driven metal-working machinery	834,352	757,163	4,865,470
Other metal-working machinery	163,418	187,612	417,897
Textile machinery	293,002	395,526	550,030
Sewing machines for domestic use	331,928	87,748	74,936
Sewing machines for industrial use	138,944	181,920	242,889
Other industrial machinery	1,183,366	1,274,547	3,916,053

Exports of power-driven machinery during June were valued at $834,352, which is greater than the volume of exports in May, but represents only 18 per cent of the volume of June, 1931. Vertical boring mills and chucking machines stand out in the June exports, exceeding those of May, and being greater than those of June, 1931.

Machinery exported in the first half of 1932 was valued at $123,399,380. This represents a decrease of nearly 60 per cent on the whole, but certain types of machinery made a better showing. Expressed in percentage of the exports for the first half of 1931, the general classifications in the 1932 list are: electrical machinery, 55 per cent; power-generating machinery except electrical and automotive, 55 per cent; construction and conveying machinery, 32 per cent; mining, well and pumping equipment, 35 per cent; power-driven metal working machinery, 28 per cent; other metal-working machinery, 58 per cent; textile machinery, 70 per cent; other industrial machinery, 36 per cent.

Gage Standards Approved

An American standard for plain and thread plug and ring gage blanks has been approved by the American Standards Association. This standard, developed by the American Gage Design Committee, includes terminology and details of construction for plain cylindrical plug gage blanks and handles; thread plug gage blanks and handles, plain ring gage blanks; and thread ring gage blanks. It also covers taper plug and ring gages for checking taper lock handles and gaging members. The work done by the committee is complementary to that in course of development in the Sectional Committee on Allowances and Tolerances for Cylindrical Parts and Limit Gages (B4), which are organized to standardize tolerances and allowances for fits between cylindrical parts and the classification and establishment of tolerances for plain limit gages.

Ratify Plans for Engineers' Council

President Lauer of the American Society of Mechanical Engineers has announced that five of the seven major engineering bodies interested have ratified the plan developed after months of effort for a new Engineers' Council for Professional Development. These five are the societies of civil, mechanical, electrical and chemical engineers, and the Society for the Promotion of Engineering Education. The other two are expected to ratify within a few weeks.

The new council will coordinate and promote efforts and aspirations directed toward higher professional standards of education and practice, greater solidarity of the profession, and greater effectiveness in dealing with technical, social and

• INDUSTRIAL REVIEW •

The spirit of optimism that is sweeping the country, based on the successful repulse of the European attack on the dollar, the rise in the bond market, the stiffening of commodity prices, and the imminence of concerted action toward resuscitating interest in machinery and equipment is beginning to be felt by the machinery trade. Only an occasional order has trickled in, it is true, but thoughts are now turned forward to September instead of back to the statistical gloom of June and July.

From Indianapolis comes word of an immediate reaction to the Home Loan Discount Bill. Plants are taking on men but there have been no important reopenings. Inquiries are better and a few orders have been booked. Not much is stirring in Pittsburgh although two Steel Corporation plants, long down, have reopened. Some of the small shops are fairly busy. An order or two has been placed. Philadelphia notes activity for electrical, hosiery and rug mills, but nothing for machinery.

A few men have been put on in Cincinnati by machine tool and other metal-working plants but business is still flat. Chicago reports some active inquiries but few orders. A Milwaukee firm says that July was its best month since February. Employment dropped steadily from May 15 to June 15, but has apparently started to reverse its path. St. Louis reports reopening of two shoe machinery plants after short vacations.

Vacations are also slowing things down in Detroit. Ford is expected to go down for two weeks and other shops are reducing forces. Aside from a body plant order for welding equipment little machinery business has been placed. Ford and Chrysler have released a few orders but General Motors is apparently out of the market. Sentiment is improving, however. Boston is much more cheerful, thanks to plant reopenings and reemployment. Some machinery business has been placed and more is anticipated. New York received the Hoover acceptance speech with enthusiasm and looks for business soon. There is none now.

economic progress. An immediate objective is the development of a procedure whereby the progress of the young engineer toward professional standing can be recognized by the public, the profession, and the man himself through the development of technical and other qualifications which will enable him to meet minimum professional standards.

•BUSINESS ITEMS•

Akron Super Steel Castings, Inc., has leased the steel foundry plant of the Adamson Machine Co., at Akron, Ohio, and plans to start operation after Aug. 10. The company will specialize in open hearth carbon and alloy steel castings. C. F. ADAMSON, president of the Adamson Machine Co., is president of the new concern. NORMAN E. DAUB, former general sales manager of the Atlantic Foundry Co., Akron, is vice-president, and C. B. MITCHELLER, general manager of the Adamson Machine Co., is secretary-treasurer.

Articles of incorporation have been filed with the Secretary of State in Indianapolis by the Vincennes Steel Corp. The corporation is formed to manufacture and deal in structural steel and has an initial capital stock of 2,500 shares common at $100 a share, and 250 shares of preferred at $100 a share. The board is composed of F. L. OLIPHANT, J. L. RIDDLE, J. E. OLIPHANT, U. U. STEVENS.

The Ceramic Drill Co. has been organized at Independence, Mo., to manufacture glass drills and drilling machinery. Incorporators are RALPH A. HAUN, OSCAR J. CAMPBELL and CECIL CAMPBELL.

Changes in the sales organization of the Norton Co., Worcester, Mass., have been announced effective July 1. WALLACE T. MONTAGUE became director of sales, abrasive products division. H. K. CLARK, formerly Chicago branch manager, became director of sales of the grinding wheel division. W. H. SHUMWAY goes from Hartford to Chicago as district manager of the grinding wheel division.

The Chandler Products Co., Cleveland, Ohio, has been licensed by the Dardelet Threadlock Corp. to manufacture and sell bolts, nuts and screws with the Dardelet self-locking thread.

The Columbus-McKinnon Chain Corp. has announced the removal of its fire welding operations from Columbus, Ohio, to Tonawanda, N. Y. The latter plant is equipped to manufacture all sizes and grades of fire-welded chain formerly made in Columbus. It is said the move assures users faster delivery and better service.

Detroit and New York interests have incorporated Consolidated Iron-Steel Mfg. Co. with headquarters in Cleveland and have consolidated four Cleveland concerns. The company is headed by I. T. KAHN, and merges the business of the Republic Structural Iron Works, Taylor & Boggis Foundry, Duplex Hanger Co. and Cleveland Lock Works. The consolidated firms will be continued under their old names and personnel.

The Davis Keyseater Co., Rochester, N. Y., has moved into its new building at 399-407 Exchange St. This is a modern one-story brick machine shop with offices connected.

The Falk Corp., Milwaukee, Wis., has announced the appointment of L. A. GRAHAM and M. A. CARPENTER as sales manager and sales promotion manager respectively for all commercial products. Foundry sales remain under the direction of A. SIMONSON, vice-president. Mr. Graham was sales manager of the Garford Truck Company. Mr. Carpenter has been in change of all advertising activities of the Falk Corp. for a number of years, as well as the sale of certain of the Falk products.

The Fitzgerald Manufacturing Co., Torrington, Conn., has organized Canadian Fitzgerald, Ltd., and secured a plant in Toronto for the manufacture of electrical appliances for the Canadian territory. P. F. FITZGERALD has been elected president of the Canadian company, and B. G. PECK, secretary.

The Hartley Wire Die Co., Inc., Waterbury, Conn., has been established to manufacture dies in a Thomaston Ave. factory. Officers are: W. H. HARTLEY, president, and E. M. HARTLEY, treasurer.

Highest bid for the Strand & Sweet division of the Polymet Corp., Winsted, Conn., was made by P. J. FITZGERALD, head of the Fitzgerald Mfg. Co., Torrington, Conn.

Hi-O-Gen Products Co. has been organized at Columbus, Ohio, to manufacture an air purifier for refrigerators. Headquarters are established at the plant of the Ohio Metals Co., Columbus. HENRY LOEB, president and general manager of the Ohio Metals Co., is one of the incorporators. New machinery is being installed in the plant.

H. W. Knight & Son, Inc., Seneca Falls, N. Y., has purchased the pattern letter business formerly conducted by A. W. Brim Co. of the same city. The Knight company has specialized in the manufacture of pattern letters for 60 years.

The Norton Co., Worcester, Mass., which recently announced the change of name of the Pike Mfg. Co. to the Norton Pike Co., following its acquisition, states that after Sept. 1 the sales and distribution of Norton Pike products in the United States will be handled through the Behr-Manning Corp., an affiliated company with main offices at Troy, N. Y., and branch offices in various cities.

Manning, Maxwell & Moore, Inc., New York, has acquired the business of the Box Crane & Hoist Corp., Philadelphia. The plan is to merge the business thus acquired with that of the Shaw Electric Crane Co., a Manning subsidiary, to operate as the Shaw-Box Crane & Hoist Co. The transaction was occasioned by the recent death of HERMAN L. WINTERER, former president and principal owner of the Box Company. The purchase does not include the Philadelphia land and buildings.

The Noble Motor Truck plant at Kendallville, Ind., has been bought by WILLIAM W. MAYER, owner of the Columbia Machinery Co. of Fort Wayne and ANDREW BROSIUS of that city. The plant has been in receivership, and the new owners will continue its operation. Mr. Mayer will supervise its management.

Organization of the ParKett Machinery Division of the Austin-Hastings Co., Inc., Cambridge, Mass., has been completed. The management is under the direction of ARTHUR B. KETTLE and FRANK A. PARKER. It will specialize in equipment for production, machine, plate, boiler, pipe, structural and sheet metal shops, but announcement of the lines of equipment to be handled has not yet been made. Five outside salesmen will operate in the New England territory.

Robins Conveying Belt Co., New York, has opened sales offices as follows: Cleveland, in charge of ROBERT WISELY, 229 Rockefeller Bldg.; Detroit, in charge of M. S. LAMBERT, 16170 LaSalle Blvd.; St. Louis, in charge of H. J. MARTINI, 7146 Dartmouth Ave.; Charleston, W. Va., in charge of R. U. JACKSON, 905 Edgewood Ave.

Reliance Electric & Engineering Co. has purchased the Cleveland Stoker Co., manufacturer of automatic coal burners for household use. The Reliance company was established by PETER M. HITCHCOCK, whose son was president of the stoker manufacturing concern at the time of his death a year ago.

Revere Copper & Brass Inc. has opened a sales office in San Francisco at 1615 Russ Bldg. R. H. BINNS, JR., now Pacific Coast manager, was formerly assistant sales manager of the Rome Division.

The Simplex Wire & Cable Co., Boston, will open a branch office in Detroit Free Press Bldg., 321 W. Lafayette Blvd., Detroit, under the management of HERMAN C. JOOS.

The Torrington (Conn.) Co. is removing machinery from the Tiley Pratt plant in Essex, Conn., to Torrington and plans to close the Essex plant.

Tools & Gages, Inc., is now located at its new plant at 3106 E. 63rd St., Cleveland, Ohio.

• PERSONALS •

CARL P. ALBERT has been elected president and treasurer of the Greene Mfg. Co., Racine, Wis., to fill the vacancy caused by the death of FREDERICK J. GREENE. Mr. Albert joined the company in 1906, and was appointed general manager in 1929. Other officers recently elected were C. S. GREENE and O. M. CHRISTIANSEN, vice-presidents, and H. J. HARDY, secretary.

E. J. DALTON, president of the Yates-American Machine Co., Beloit, Wis., has succeeded JAMES R. MORASH, deceased, as general manager of the General Refrigeration Co., Beloit. He will continue as president of the Yates-American company, of which ALVIN HAAS is general manager.

RALPH L. DUNCKEL, formerly with the International Motor Co., has been placed in charge of production and purchasing at the Bridgeport plant of the Kron Co.

HAMILTON GARNSEY, JR., has been appointed works manager of Goulds Pumps, Inc., Seneca Falls, N. Y.

FRANK J. OLIVER, JR., formerly western editor of *American Machinist*, has been appointed co-ordinator, or industrial director, at the college of engineering of the University of Detroit. The college is one of the cooperative engineering schools which place emphasis on practical work in industry and send their students out to work in accepted firms on a part-time basis. Among Mr. Oliver's duties will be those of placing the students in industrial plants and supervising their activities while outside the school.

MARK F. LACEY, New Britain, Conn., has been elected vice-president in charge of sales and director of Peck, Stow & Wilcox, Southington, Conn., to succeed A. L. SESSIONS, who has retired.

DONALD J. STRAUCH, Moline, Ill., has been named general manager of the E. & T. Fairbanks & Co., Moline plant. He has been in charge of the mechanical engineering and production departments and for the last five years directed purchasing and traffic.

• OBITUARIES •

MALCOLM L. BARBEAU, 61, secretary and treasurer of the S. Howe Co., Inc., manufacturer of grain cleaning machinery and equipment, Silver Creek, N. Y., died recently.

PATRICK J. DELANEY, 68, formerly assistant master mechanic of the Allegheny, Pa., plant of the Pressed Steel Car Co., Pittsburgh, died recently.

M. MARKHAM FLANNERY, director of trade practice conferences for the Federal Trade Commission, died in Washington, Aug. 3. He was widely known in business circles because of his connection with that work since 1919.

EDWARD J. FRITTON, 59, pioneer automotive engineer and secretary and general manager of the Covert Gear & Mfg. Co., Lockport, N. Y., died recently.

JULIUS GOSLIN, president of the Goslin-Birmingham Mfg. Co., Birmingham, Ala., died in New York recently.

PHILLIP A. MYERS, 79, inventor and head of the F. S. Myers & Bros. Co., pump manufacturer, Ashland, Ohio, died Aug. 5 from injuries sustained in an automobile accident.

GEORGE W. ROBESON, 62, president of the Robeson-Rochester Corp., manufacturer of cutlery and metalware, died Aug. 7.

F. W. SINRAM, president of Gears & Forgings, Inc., died Aug. 2. Mr. Sinram has been a leader in the American Gear Manufacturers Association for years, and was one of the organizers. Elected the first president of the association in 1917, he served continuously until 1923, when he was elected honorary president for life. During the war, Mr. Sinram was appointed chairman of the war service committee of the gear industry and started the work of gear standardization. His business career started with the Van Dorn & Dutton Co., shortly after 1903, and in 1910 he was made secretary of that company, and in 1918, vice-president. He was also one of the founders of the Van Dorn Electric Tool Co.

F. W. SINRAM

PRATT E. TRACY, president and chairman of the executive committee of the Air-Way Electric Appliance Corp., Toledo, Ohio, died Aug. 3. He formerly was president of the Toledo Screw Products Co., having organized that company for war materials work in 1915. It was later merged with the Arrow Mfg. Co., the two forming the basis for the formation of the Air-Way company. Mr. Tracy was elected president of the latter concern upon its organization in 1924, and held that position until his death.

CHARLES E. WATTERSON, president of the Sheffield Machine & Tool Co., Dayton, Ohio, died recently.

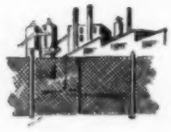
• MEETINGS •

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. National Machine Shop, Practice Meeting, Buffalo. Week of Oct. 3. Calvin W. Rice, secretary, 29 W. 39th St., New York, N. Y.

NATIONAL METAL CONGRESS & EXPOSITION. 174th Regiment Armory, Buffalo, N. Y., Oct. 3-7. Sponsored by A.S.S.T., with cooperation of A.S.M.E., Institute of Metals and Iron & Steel Divisions of A.I.M.E., A.W.S., S.A.E., and the Wire Association. W. H. Eisenmann, 7016 Euclid Ave., Cleveland, Director.

NATIONAL SAFETY COUNCIL. Twenty-first annual safety congress, Washington, D. C., Oct. 3-7. National Safety Council, Civic Opera Bldg., 20 North Wacker Drive, Chicago.

SOCIETY OF AUTOMOTIVE ENGINEERS. Aeronautic meeting, Hotel Statler, Cleveland, Aug. 30-31. Production meeting, 174th Regiment Armory, Buffalo. Week of Oct. 3. John A. C. Warner, secretary, 29 West 39th St., New York, N. Y.



In Our Own Shop or Outside?

"Hello, Ed, how're things at the factory?"

"Oh, it's still running, but it's darn lonesome. How are things with you? Got your factory built?"

"No, we're not worrying about building a factory yet, but we are worrying about where to do our work. Mason has a few old machine tools, and he wrote me he was shipping them down by freight. I've got to make up my mind where to put them."

"What's the argument, anyway?"

"Well, we haven't quite decided whether we will rent a factory, buy some machine tools on time and make up compressors for the orders we get, or just do engineering work together with the experimental work that may be necessary and farm out the manufacturing work."

"What are the pros and cons of the proposition? I thought the experimental work was all done."

"It is, practically. Of course there are always one or two points to clean up, and there are new applications continually coming up. There's a whale of a difference between building a rotary compressor for sulphur dioxide as a refrigerant, and one for ammonia."

"Why don't you try to design a compressor that you can easily convert into a pump? Then you would have two things to sell and only one to manufacture."

"We don't have to try, big boy. We've got that licked already."

"Yeah? What else will that compressor do?"

"It would take me all afternoon to tell you that. Just now I am trying to train it to support me and my family. It's a wonder, Ed, and I believe it will do it."

"I'll take your word for it, I made a mistake in mentioning compressor. Say, Al, why don't you rent the old pump shop? It ought to be just about what you'd want."

"I've looked at it, Ed. It's a wreck. I'm afraid that's out."

"Well, I don't know of any other shop around town, Al. Better let us make them."

"No, thanks. I know the old shop too well. A lot of rotten jobs have come out of there, and some of them were mine. We want good work, not finally, but the first time."

"What do you figure on doing, then? Leaving town?"

"No, indeed. I have always had in mind that I could use my garage if we confine ourselves to experimental and engineering work. It's brick, and I know the roof will carry a line shaft and a countershaft or two. I've always talked about having a little shop there some time, you remember, and maybe the some time has come."

"What'll you do with your car, park it next door?"

"Yes, I can hire space there."

"Why isn't that the answer then? What's all the indecision about?"

"I think it is the answer, Ed, but I'm greedy, I guess. I hate like the dickens to let some one else make all the money for building the compressors, when we need it so badly ourselves. If we let the work out, it's going to cost so much that Mason and I won't dare charge much for our end of the work."

"Aha! Changed your song about the economy of having work done outside, haven't you?"

Would it benefit the new firm to rent a shop and equip it for manufacture, or had it better stick to engineering and small scale experimental work?

Discussion

Cutting Loose

Al is not one whit too careful. It is better that he should operate without anyone's being able to point a questioning finger. Of course, on the basis of merit alone, he has a perfect right to solicit work from his old firm, to buy machines from it, or to have any other proper business dealings with it. He is entitled to any consideration which may be accorded him through the fact that the old firm knows him to be trustworthy, as a result of his service. Such relationships could only work out to the good of all parties concerned. The management should be glad to help Al in his new enterprise.

Though Al is careful concerning his relationship with Williams, it appears that his care is not so well rounded out. He suggests the purchase of some old machines which Ed declares belong in the boneyard. How is a new undertaking to prosper, in the face of present-day competition, with such equipment for a start? Why spend good money, though it be spent in ever so small an amount, for a liability?

—JOHN E. HYLER

Is This a Good Time to Quit?

Dear Al:

For a man to quit his job now, because of disagreeable features connected with it, is to quit without good reason. List the disagreeable features one by

one and you cannot escape them by going into business on your own.

Worry and uncertainty are certainly going with you and probably in increased measure. Responsibility for the welfare of others will be extended from the part responsibility every foreman has for the welfare of his men to full responsibility for digging up the money to meet the payroll. In addition, a whole new group of persons will become in a measure dependent on you in the form of creditors and investors.

No; if carrying responsibility for others and worrying nights about the business is too much for you as a foreman, you will certainly not escape them by becoming a proprietor. If these things bother you, maybe you need a rest and surely the acquisition of a philosophy which teaches: "I am going to give without restraint everything I have to this job. I am going to run this department as if it were my own shop. I am going to make this business a success, but if conditions over which I have no control cause it to fail, I shall have a clear conscience and make no apologies."

On the other hand if you are thinking of quitting because you see a real opportunity doing something else, and if after considering all the chances you think the reward worth the gamble, burn your bridges and go to it.

—Glenn F. Griffen.

Dominant or Dumb?

To get the best results, the head of a firm must be neither dominant nor dumb, but between the two. If he is too dominant, he will not get the best out of his subordinates; if he is dumb, he might as well not be there.

The successful man is one who can discuss a subject with his subordinates, get their ideas, adopt them if good, but be dominant enough to resist any idea which does not seem practicable.

—W. E. Warner,
Herts, England.

Stockholder vs. Employee

It is only logical that years of prosperity should pay for the years of depression. With that in view, companies built up reserve funds, but it is human nature both with corporations and individuals, to be reluctant to take that which was put away for a rainy day.

These reserves were built up by the cooperation of both the shareholders and the workers, during the years of prosperity when it was being said that never again would there be class hatred, poverty, nor want. Under those circumstances, it is unfair to expect the workers to shoulder the losses of the lean years by cuts of wages in order to pay dividends.

Possibly someone may say that the workers should have created a reserve fund for themselves instead of spending their money in a frivolous manner. It may be true that a small minority have been careless and indifferent, but only the industrious and thrifty remain in our factories to-day, for all the drones have been weeded out, as well as many thrifty ones.

To make any further cuts on the workers is not to the company's nor

industry's interest. No firm that means to march victoriously along, can hope to do it with workers whose feet are treading backward. There is not a company that does not hope that every single individual will spend more, and any firm that cuts wages is acting contrary to its own interests.

If our present system is to continue, it is not sufficient to say in words: "Our system has stood the test of time and gives greater individual freedom and comfort than does any other." Words will not do; reality is needed to-day. Our present system must justify itself, and make it possible for all to have a decent living who are willing to work.

—A. I. Cook,
Colchester, England.

The President of the Mid-City Machine Works admits having previously cut dividends and wages simultaneously, in order to meet depreciated profits. Is there any reason why this precedure should not be followed a second time, in its entirety, as against the half-formulated idea of reducing wages only?

Alternatively, presuming the usual quota has habitually been placed in the reserve fund, why not make a practice of relegating a portion of this fund back to dividends in order to insure such dividends at the end of each period? When the reserve fund falls below a specific figure, then would be the time for the executive to recommend that the board reduce wages on a percentage basis which would apply to worker and director alike.

The directors' board, which while evading loss to themselves, reduces the income of the employees, has no right to expect a generous reciprocation from the worker in the form of useful work done. And from a very real viewpoint, management is dependent on the goodwill of the worker.

—E. Wardle.
Hetton-le-Hole, England.

New Brooms

Several years ago our foreman in charge of the assembly department left to go into business for himself, and there was no one who had enough background to step into the vacancy. We did have a young fellow who, with a little executive training, could be brought along. In the machine room was an efficient foreman and a splendid assistant. We placed this foreman temporarily in charge of the assembly department. Although not familar with all the details of the new work, his splendid training plus the knowledge of the young fellow, who was being groomed for the job, made everything work out fine. After the young fellow had been versed in his duties, the machine foreman went back to his department, a better man than ever, because he now knew exactly what the assembly department was up against if the materials are not machined properly.

Our present business conditions have made it necessary to switch men in our various departments and it has increased rather than decreased the efficiency in most instances. A good foreman should be familiar with the work of other departments.

—E. F. Werner,
Superintendent,
American Fixture & Showcase Company.

Other Times, Other Men

I believe if some firms had their way, they would prefer regular complete changes of workers. Some do not appear to know when they have a good set of men, consequently are always itching to be rid of many of them. Such a belief is born of ignorance concerning the true character of the men. Granted some workers are untractable, and others take liberties when used to a shop, but these should be dealt with individually. As a rule, every year adds to a man's value: he loves his work and is as interested as though he were a shareholder. Because men make themselves as comfortable as possible, it must not be assumed they are making a convalescent home of the plant or are idling time away. The fact is men gradually learn to work to best advantage for themselves and the firm. There need be no prejudice against men after a few years' service—rather they should be thought more of, for they

are the backbone of a shop. They do anything reasonable to please, and are amenable to discipline. Drive them away, and they will prove irreparable losses.

—Wm. Bryce,
Sheffield, England.

Industrial progress is not something which lies dormant for years and leaps forward to a new era in a matter of months. Progress is gradual, each day being an era in itself. If Al's activities had been progressive, the situation with which he is faced could not have arisen, because the men and their foreman would have progressed with the work.

Al is responsible for the type of man he has, because they are all, to some extent, the product of an association with him. Yet, when he finds that this human material is spoiled, Al decides to throw it on the scrap heap and obtain new stock, which, when it also has deteriorated under his supervision, will doubtless be scrapped too.

—D. Q. Dunstone,
Durham, England.

No Questions Asked

Judging from several years' experience working for two well known inventors, an open-minded attitude is to be preferred as against an "It-can't-be-done" policy. The inventor in question proved himself and it is quite possible he himself has doubts of the success of the design under review but wishes to make certain by the only practical means.

One inventor informed me that he made his money by spending it. Certainly he produced many jobs costly in both time and money, but there was method in his madness. When success was reached, every alternative had been tried, and it was quite safe to go ahead, thus leaving others far behind. Another inventor claimed that without his failures there would have been no successes. Both died rich, and neither would have allowed any interference or criticism of their designs.

If an obvious error is found upon a drawing, this should be pointed out and permission sought for its correction, but all other matters can be left to the inventors themselves.

—F. P. Terry,
Belfast, Ireland.

A manufacturing jobber would be far outside his realm in telling a reputable inventor that his design would not work; especially in such work as engines that cost thousands of dollars to build. Constructive criticism involving changes that would simplify the making of parts would be more in line for a jobber to undertake. Such changes would not disturb the design of a mechanism but would give a better product for less money.

An example of this was recently observed. A jobbing gear manufacturer had orders for a number of non-metallic gears of various sizes. The gear maker suggested making the steel hubs slightly larger so that the smaller pinions could be made from center disks. Designs that would prevent ragged edges on the teeth were suggested among others. The customer was well pleased with the proposed changes and gladly adopted them.

Changes of this kind can be safely suggested as the jobber is sure of his ground. To go beyond one's own field may turn out to be embarrassing, which would not reflect favorably on future business. —L. F. Sevenson.

The Outsider

The thought that an outsider can come into a plant and suggest valuable improvements is, of course, based upon the idea that the outsider may have had better experience in other places. There is a flaw in this reasoning, if viewed from a broad angle.

There is no man who knows as much about the needs, the peculiar conditions and the possibilities of a department as the foreman of that department providing he is competent and intelligent. If the management does not know a competent foreman from a breezy bluff then there is not much hope for a general improvement anyhow. Now, granting

a good foreman in charge of the department, what is the matter? There will be lots of good ideas in use at other plants that this foreman will never think of, and for this reason, his department is not efficient as it might be.

Ought the management, therefore, to hire an expert, at a cost of from $50 to $100 per day to tip the foreman off? A few hundred dollars spent this way might save thousands. No. The management should not do this because there is a much better and far more efficient method. It should take these few hundred dollars and every month or so send the foreman to various plants in the country to study, first hand, how similar work is handled by other firms.

—Geo. B. Pearce.

Poetry of Motion

In thousands of shops the need for motion study is evident. Incentive payment should not start until the possibilities of motion study have been exhausted. It produces greater results in a shop accustomed to motion study. The money urge, combined with the educational benefits of motion study, leads workers to think out new methods of saving wasted effort. Motion study cannot be imposed arbitrarily but must be explained step by step to get best results. It has a surprising way of developing initiative in youngsters, as this example shows.

A boy was given a difficult new job, and by mid-week his earnings were down. For such cases, the job of polishing ornamental, brass-headed nails was held in reserve. It was hard work but paid well. He was given a five days' supply, but in two hours he had finished the lot. Weeks afterwards, I found out how he did it. He took an old 36 x 6-in. wooden pulley, wrapped webbing around it, and rolled it over the nails on the floor, picking up hundreds at one time. The rim of the pulley was brought against the mop and the lot was polished in a few minutes. The webbing was then ripped off roughly and the nails flew out. Workers accustomed to motion study often do this sort of stunt—and the shop profits. —M. P. Dalton,
Kent, England.

Iron and Gold

Broadly speaking, any foundry which cannot compete with a rival ought to close down at once. The foundry superintendent's opinion, although naturally biased, agrees in the main with the method adopted by the majority of up-to-date concerns.

After the castings have left the foundry the liability attached to them rests with the purchaser. Such castings could be sold to the machine shop, and profits accruing thus credited to the foundry and handed over as a quota to the firm's total profits. Each department would then only merit censure when its net profit came below the percentage demanded from it in order to make up the requisite income. The effect would be to give each department head an added incentive to conduct his particular branch of the business on an efficient basis.

When making a comparison, the works manager would do well, where the costs are based on the flat percentage system, to that used by the opposing firm, treat- to recalculate these in a manner identical ing the foundry as a separate unit.

—E. Wardle,
Hetton-le-Hole, England.

American Machinist
Reference Book Sheet

Design of Cone Pulleys

IN DESIGNING a pair of stepped or cone pulleys, there is no simple relation between the diameter of each step and the diameter of the corresponding step of the other cone. If the shafts were infinitely far apart, the sum of the diameters for each pair would be the same. But because of the angularity of the belt, especially at shorter distances, this assumption will not hold true under practical conditions.

The method for determining formulas for the correct diameter of the steps on the second cone, the steps on the first cone being arbitrarily assumed, is as follows:

As in Fig. 1, lay out two similar pulleys on the axes X and Y. Identify one set of steps as a_1, a_2, a_3, . . . and the other set as z_1, z_2, z_3, . . . Project the respective radii horizontally and vertically until they intersect. Next draw two theoretical pulleys a_t and z_t of such radius that the corresponding pulley would have zero radius, and project the radii to the axes. Through these intersections draw curve ACZ.

From this curve it may be deduced that:

1. The curve is symmetrical about a line joining the intersection of projections from two pulleys of equal radius with the pole of the coordinates O.

2. The curve may be assumed to be an arc of a circle.

3. The curve intersects the axes at the projections of the radii of the theoretical maximum size pulleys.

4. The chord N is the hypotenuse of a 45-deg. triangle whose two sides are equal to the radius R of the theoretical pulley.

5. The middle ordinate of the curve lies on the common diagonal of two squares whose sides are the radius r of the middle pulley and half the radius R of the theoretical pulley.

6. With a chord and the middle ordinate known, the radius W of the curve may be found.

$$W = \frac{M^2 + N^2/4}{2M}$$

but $M = (r - R/2)\sqrt{2}$
and $N = R\sqrt{2}$

Therefore:

$$W = \frac{[(r - R/2)\sqrt{2}]^2 + \frac{1}{4}[R\sqrt{2}]^2}{2(r - R/2)\sqrt{2}} = \frac{(2r - R)^2 + R^2}{(2r - R)\sqrt{8}}$$

It is now possible to determine the

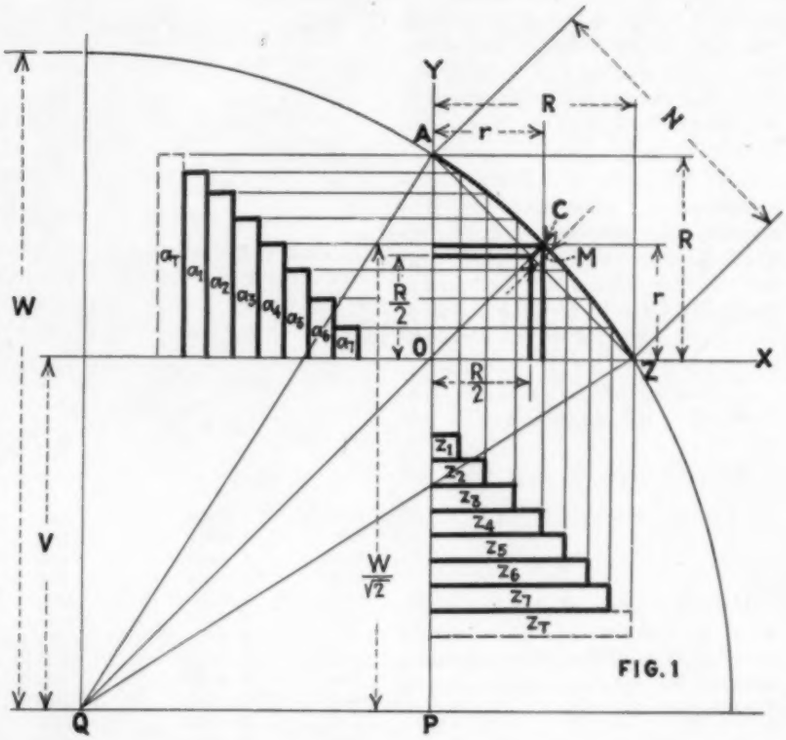


FIG. 1

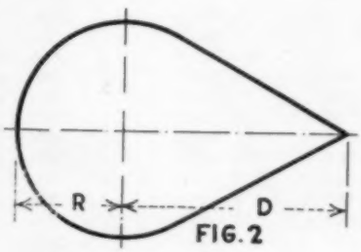


FIG. 2

FIG. 3

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American Machinist
Reference Book Sheet

Design of Cone Pulleys

steps of a cone pulley when the following are known:

1. The distance D between shaft centers.

2. Radii of two of the pulley steps, preferably of the two having the same diameter, as seen in Fig. 3.

3. If the dimensions of the two equal pulleys are not given the common radius can be found by referring to the Reference Book Sheet, "Belt or Chain Length Determination," (*AM*—Vol. 75, page 365). From the belt length subtract twice the center distance, or 2 D, and divide the remainder by 2 π. The quotient will be the radius of the two equal pulleys, or r.

4. Divide r by D. Refer to the accompanying table and find the nearest value corresponding to this quotient under the r/D column. Under the R/r column will be found a multiplier for r to give the value of R. Now solve for W in the foregoing equation.

5. Dividing W *by* $\sqrt{2}$ and subtracting r, the dimension V is obtained.

Then in terms of right triangles:

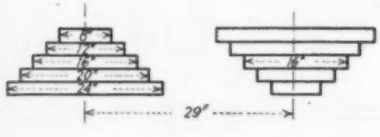
$$W^2 = (V + a_1)^2 + (V + z_1)^2$$
$$W^2 = (V + a_2)^2 + (V + z_2)^2$$
$$W^2 = (V + a_3)^2 + (V + z_3)^2$$

Having a series of steps of radius a_1, a_2, a_3, and the radii of the corresponding steps of the other cone being wanted, the equations above may be transformed to:

$$z_1 = \sqrt{W^2 - (V + a_1)^2} - V$$
$$z_2 = \sqrt{W^2 - (V + a_2)^2} - V$$
$$z_3 = \sqrt{W^2 - (V + a_3)^2} - V$$

Example:

a_1 = 4 in. a_2 = 6 in.
a_3 = 8 in. a_4 = 10 in.
a_5 = 12 in.



To find: z_1, z_2, z_3, z_4, and z_5

Starting with the two pulleys whose radius are 8 in.

$$\frac{r}{D} = \frac{8}{29} = 0.27586$$

Referring to the table

R/r for 0.27000 = 1.7360
R/r for 0.28000 = 1.7282
0.0078

Interpolating:

0.0078 × 0.586 = 0.0046

Therefore R/r for value of r/D of 0.27586
= 1.7360 − 0.0046 = 1.7314

R = 8 × 1.7314 = 13.8512

$$W = \frac{(2r - R)^2 + R^2}{(2r - R)\sqrt{8}} = \frac{196.4739}{2.149\sqrt{8}}$$

Log. 196.474 = 2.293305
Colog 2.149 = 9.667764 − 10

Colog $\sqrt{8}$ = 9.548455 − 10

Log W = 21.509524 − 20
Log W^2 = 3.019048
W = 32.323
W^2 = 1044.83

$$V = \frac{W}{\sqrt{2}} - r$$

Log W = 1.509524
Colog $\sqrt{2}$ = 9.849485 − 10

Log $W/\sqrt{2}$ = 1.359009
$W/\sqrt{2}$ = 22.8565
V = 22.8565 − 8.0000
= 14.8565

From equation $z_1 = \sqrt{W^2 - (V + a^2_1)} - V$

z_1 = 11.397

Similarly
z_2 = 9.837
z_3 = 8.000
z_4 = 5.805
z_5 = 3.124

r/D	R/r	r/D	R/r	r/D	R/r
.050	1.9400	.185	1.8061	.320	1.6982
.055	1.9344	.190	1.8017	.325	1.6946
.060	1.9288	.195	1.7973	.330	1.6910
.065	1.9234	.200	1.7930	.335	1.6874
.070	1.9180	.205	1.7887	.340	1.6838
.075	1.9125	.210	1.7845	.345	1.6802
.080	1.9072	.215	1.7803	.350	1.6766
.085	1.9019	.220	1.7762	.355	1.6732
.090	1.8966	.225	1.7720	.360	1.6697
.095	1.8915	.230	1.7679	.365	1.6662
.100	1.8864	.235	1.7638	.370	1.6627
.105	1.8814	.240	1.7597	.375	1.6593
.110	1.8763	.245	1.7557	.380	1.6558
.115	1.8713	.250	1.7517	.385	1.6524
.120	1.8663	.255	1.7477	.390	1.6490
.125	1.8615	.260	1.7438	.395	1.6456
.130	1.8657	.265	1.7399	.400	1.6423
.135	1.8519	.270	1.7360	.405	1.6389
.140	1.8471	.275	1.7321	.410	1.6356
.145	1.8423	.280	1.7282	.415	1.6322
.150	1.8377	.285	1.7244	.420	1.6289
.155	1.8330	.290	1.7206	.425	1.6256
.160	1.8284	.295	1.7168	.430	1.6223
.165	1.8239	.300	1.7131	.435	1.6190
.170	1.8195	.305	1.7093	.440	1.6158
.175	1.8151	.310	1.7056	.445	1.6126
.180	1.8106	.315	1.7019	.500	1.6094

Contributed by Clinton C. Hubbell

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• IDEAS FROM PRACTICAL MEN

Fixture for Boring and Turning Pulleys

A. W. DILTS

Having a large quantity of 8 x 4-in. pulleys to bore and turn, we made the fixure illustrated in Fig. 1 so that both operations could be performed at one setting in a turret lathe. The outer end of the fixture was made to fit the draft angle at the inside of the pulley rims and the center was counterbored to clear the hubs. Four holes were drilled and reamed to receive the floating clamps *A*, which are free to rotate and to slide in or out of the holes until held by the binders *B*. The clamps hold the spokes of the pulleys against the hardened pins *C*, clamping pressure being obtained by set-screws bearing against the opposite sides of the spokes.

In operation, a pulley is pushed on the fixture until the draft angle contacts with the outer diameter. The pulley is then rotated until the spokes enter the slots in the floating clamps, which are then tightened on the spokes. After truing the pulley sidewise, the clamps are tightened in their holes by the action of the binders *B* through screwing down the nut on the floating bolt *D*. The pulley is now held against movement in any direction and without danger of distortion, since all binding members are free to float until the nut on the floating bolt has been screwed down.

For turning the face of the pulley, the serrated roughing tool *E* is used to break up the scale and the finish turning is done by the tool *H*, the tools being mounted on opposite sides of the work in the cross-slides. Boring and reaming are done by the usual tools held in the turret.

Pulleys having either three or six spokes can be held by making the fixture with three floating clamps, as shown in Fig. 2. Two of the clamps are tightened in their holes by binders similar to those described, while the third clamp is tightened by a floating eyebolt.

Squaring Studs in Sheet-Metal Bases—*Discussion*

FRANK BROWETT

Triangle Tool & Die Company

Referring to the article by Charles H. Willey under the title given above (*AM* —Vol. 76, page 680), I would like to say that in my opinion Mr. Willey's trouble lies in riveting the studs by spinning. If he would make the tools here illustrated and use them in a press, the bases will not be distorted and the studs will stand square.

In operation, the studs are placed in holes in the die and the base is placed over the studs, the nest keeping it central. Both studs are then riveted by one stroke of the press. I believe that this method will be faster than riveting the studs by spinning and will eliminate the straightening operation. The only drawback is that a small teat will be left on each stud, but as the teats project inside the base they will do no harm.

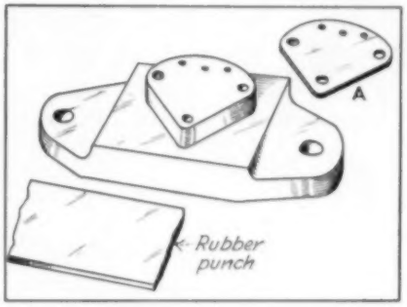
Not knowing the diameter of the studs used by Mr. Willey, I cannot give him the size of the holes in the punches, but $\frac{1}{32}$-in. holes counterbored to $\frac{1}{16}$ in. for the rivet heads will do for $\frac{1}{8}$-in. studs.

A Rubber Punch

CHARLES H. WILLEY

Superintendent of Manufacturing, Hoyt Electrical Instrument Works

"Believe it or not" (with apologies to Ripley), I can prove this one. I have just found out that it is possible to make a piece of $\frac{1}{8}$- or $\frac{1}{4}$-in. flat rubber, such as a section of a heavy-duty inner tube for a truck tire, to act as a punch for blanking a limited quan-



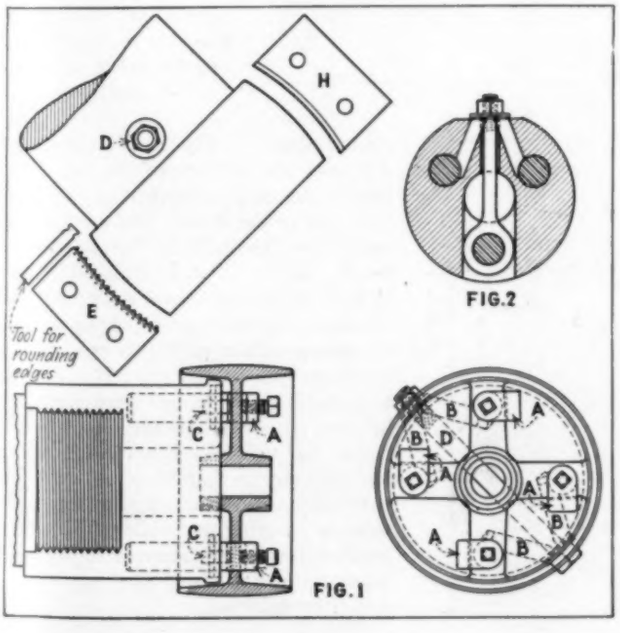
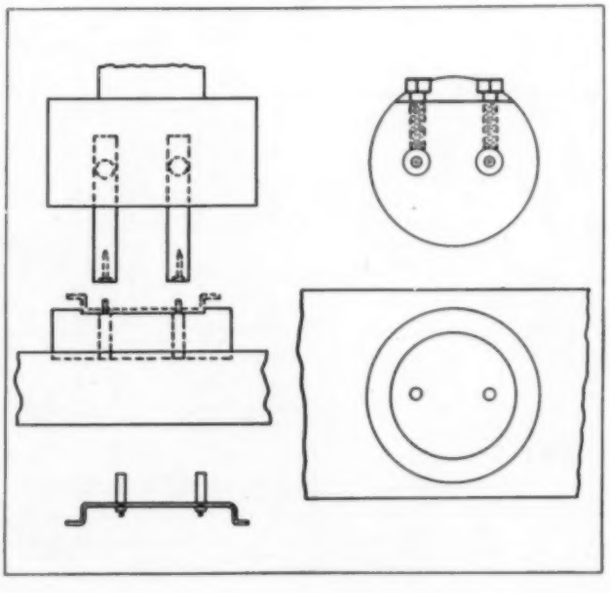


FIG. 1

FIG. 2



tity of parts from Micarta, Formica, or fiber $\frac{1}{32}$ in. in thickness.

We required some insulating pieces for one of our recent types of instruments and the diemaker was rushed to get out the tools. As soon as he had the lower die made and hardened, he said, "I can give you a couple of hundred blanks now, without waiting for the upper die and the punches." This he proceeded to do by using a piece of rubber for the punch. The lower die, shown in the sketch, was placed on a base, while in the press ram was a flat plate. The stock was placed on top of the die and the rubber was laid on top of the stock. When the press was tripped, the result was a clean, or nearly clean, stamping like the one at *A*. About twenty pieces were punched with one piece of rubber. The holes were pierced cleanly and the outside was cut fairly clean.

Fixture for Straddle Milling

IRA S. WILLIAMS
Western Electric Company, Baltimore Plant

Having to machine quantities of cranks, levers and links similar to the shape shown in Fig. 1 and finding them difficult to hold for straddle milling, we designed the fixture illustrated in Fig. 2 to handle such jobs.

The two V-blocks *A* and *B* are mounted on separate bases, the one at *A* being fixed on its base, while the one at *B* slides and is moved for clamping by the lever *C* and cam *D*. Either of the bases can be clamped at any place on the machine table, thus adapting the fixture for holding work of different lengths. Both bases are provided with tongues to fit the slot in the machine table to align them accurately. The V-s are serrated similar to those in a pipe vise to increase their holding effect. Opposing the cam are the spring-actuated plungers *E*, which move the V-block *B* away from the work when the pressure of the cam is released. Being thinner than the work to be milled, the V-blocks will pass between the straddle mills without interference. The adjustable stop *H* is used as a registering point in setting up the work.

Either of the V-blocks can be removed from its base and can be replaced by devices for holding and supporting work of different characters.

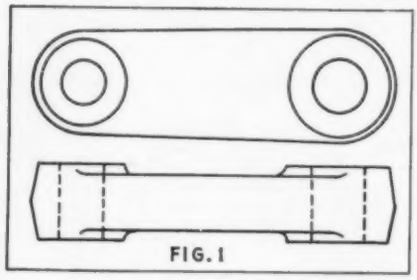


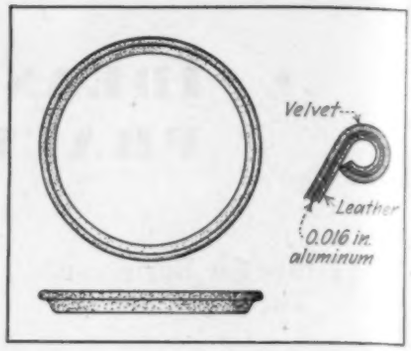
FIG. 1

Press Working of Metals Covered With Various Materials

ERNEST C. ALLEN

While the practice of forming containers and other articles from metal that has been lithographed or printed upon is fairly well known, it is not so well known that shallow articles of simple shape can be formed from thin, soft metal that is covered with paper, leather, cloth and other materials.

The small tray illustrated is made from 0.016-in. aluminum that is covered on one side with velvet and on the opposite side with leather. The processes of drawing, blanking and spinning such covered material are capable of a wide application, provided that both the article and the tools for its production are designed with an intelligent view of their limitations in mind.



It will be noted that the metal in the tray illustrated is both thin and soft, therefore, the unit of pressure required to form it is low. If the same tray were to be made from 0.060-in. steel that was covered with the same materials, it is obvious that the velvet would be crushed. Drawing operations should, therefore, be attempted cautiously, as the soft nature of the covering materials causes their thickness to change under pressure. Therefore, wrinkling at the draw ring is difficult to control.

In the case of the tray in question, it was drawn in two operations and then blanked. The stock was rigidly held by the pressure pad and the metal was drawn from the center. The drawing and blanking operations are shown diagrammatically in Fig. 2. The first draw depresses the bottom to the full depth, leaving an easy curve at the corner, as indicated in the sketch. The second draw forces this curve into the angle indicated which is the finished shape. Pulling the metal over a draw ring was, therefore, avoided and pulling it over the sharp corner of the punch was reduced to the minimum. The drawing and blanking operations were performed in one set of progressive tools. The reason for this procedure was not only for economy in handling but to eliminate the hazard of damage to the rather delicate covering materials if the partly-finished trays were allowed to lie about between operations. The edges were curled by spinning.

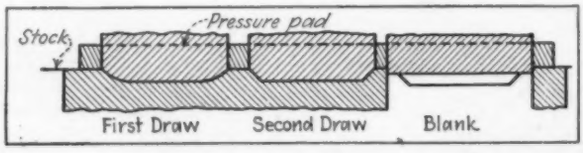


Fig. 2 — Drawing and blanking operations on small tray of 0.016-in. aluminum covered on one side with velvet and on the other side with leather

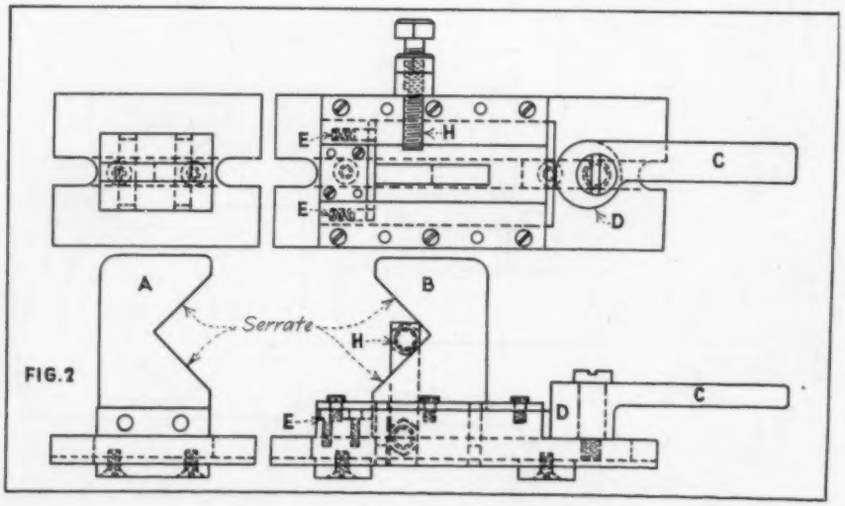


FIG. 2

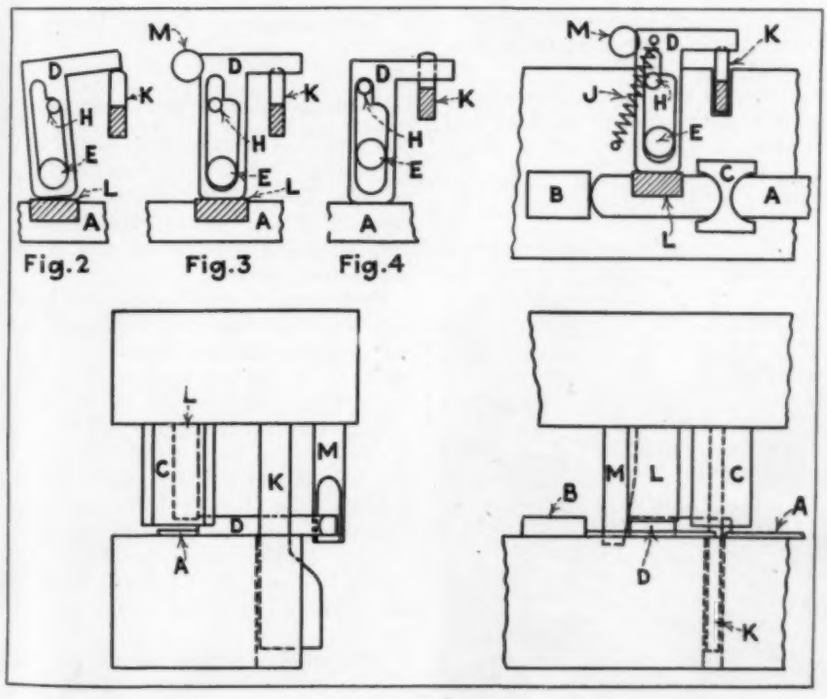
A Simple Knockoff

R. H. KASPER
Master Mechanic,
Steel Heddle Mfg. Company

The construction of a simple knockoff for pushing blanks from the face of a die is shown in the illustration. The stock *A* is fed lengthwise of the die against the stop *B* and is cut off by the punch *C*, leaving the ends rounded. Riding on the upper face of the die, the knockoff *D* is retained by the studs *E* and *H*, the heads of which have been omitted from the sketch for the sake of clearness. Spring *J* tends to draw the knockoff forward, the return movement being accomplished by the upward movement of the cam *K*, which is attached to the punch-holder. Punch *L* is shorter than punch *C* and does not come into contact with the stock, its sole office being to restrain the forward movement of the knockoff until the punch *C* has cleared the stock on the upward movement of the ram.

On the upward stroke of the ram, the knockoff is brought to its extreme rear position by the cam *K*. Since the cam contacts with the projecting finger of the knockoff, it tends to exert pressure to the left, causing the knockoff to swing and lock on the stud *H*, as indicated in Fig. 2. The stock is then fed against the stop *B*. As the ram descends, the flat, angular surface of pin *M*, attached to the punch-holder, contacts with the left side of the rear end of the knockoff, causing it to swing to the right and disengage itself from the stud *H*. Spring *J* then draws the knockoff forward and against the punch *L*, occupying the position indicated in Fig. 3. Further downward movement of the ram cause the punch *C* to cut off the stock.

As the ram ascends, the punch *L* rises out of contact with the knockoff, permitting it to be drawn forward by the spring *J*. Here the knockoff strikes the blank and pushes it off of the die, as indicated in Fig. 4. Further upward movement of the ram again causes the cam *K* to return the knockoff to its locked position on the stud *H*, thus completing the cycle. It will be noted in Fig. 3 that the rear edge of punch *L* projects slightly beyond the rear edge of the blank. As soon as the knockoff is released by the rising of punch *L*, it acquires sufficient momentum to strike the blank with considerable force.



A Tilted Rest for Grinding Sheet Metal

A. KENDALL
Hamilton, Ontario, Canada

The use of the tilted rest shown in the illustration will be apparent when accompanied by the following explanation: If sheet metal is held so that its edge is at a right angle to the face of the grinding wheel, it will chatter so badly that it will be very difficult to hold in position. If the edge of the metal is held vertically or at a right angle to the grinder spindle, it will soon cut into and spoil the face of the wheel. While chattering will be eliminated, the layout lines on the metal can not be seen while the grinding is in process.

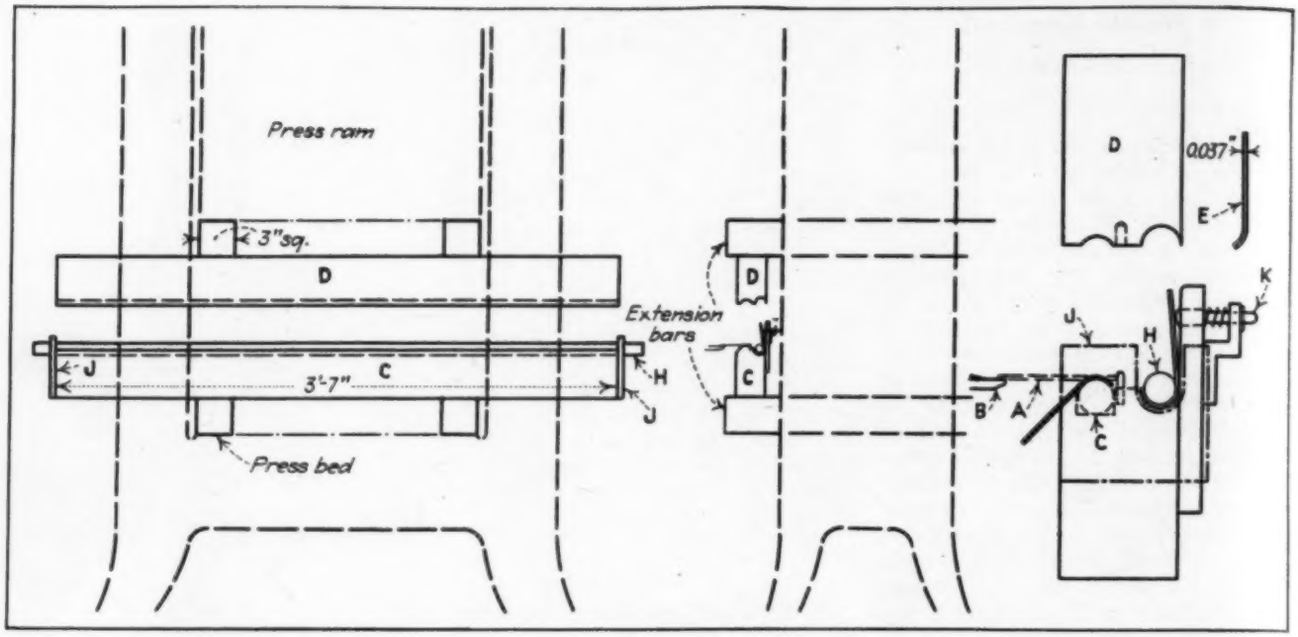
I have found by experience that if the edge of the metal is held against the face of the wheel at an angle of about 45 deg. to the axis of the spindle, there will be very little chatter and the layout lines can be followed quite easily. As a repairman, I have often had sheet-metal guards to make and I have adopted the tilted rest for grinding the edges to the desired shape after cutting the blank out of the sheet. I can recommend this device to any repairman having to grind the edges of sheet metal.

Press Tools for Making Sheet-Metal Tubes—*Discussion*

STANLEY PIVONSKI
Tool Designer,
Anchor Post Fence Company

A short time after reading the article by Carl G. Alt under the title given above (*AM*—Vol. 76, page 534), I was called upon to design a set of tools for forming tubes 42 in. long and $\frac{3}{4}$ in. inside diameter, the stock being 0.037 in. thick.

By modifying Mr. Alt's design, as shown in the illustration, and doing the job in two operations, the tools worked very satisfactorily. In operation, the strip stock *A*, is placed on the trip-stop *B* and the die *C*. When the punch *D* descends, it forms the bend shown at *E*. Next, a 48-in. rod of $\frac{3}{4}$-in. round, cold-rolled steel *H* is placed between the guides *J-J* and acts as a mandrel upon which to form the tubes. Then the piece *E* is placed behind the mandrel and is held out at the top by spring-actuated plungers, one of which is indicated at *K*, so that it will positively enter the semi-



circular opening in the punch *D*. As the ram descends, the lower part of piece *E* is pushed part way around the mandrel and the upper part is curled and forced down upon the mandrel by the punch *D*, the edges meeting and forming the tube.

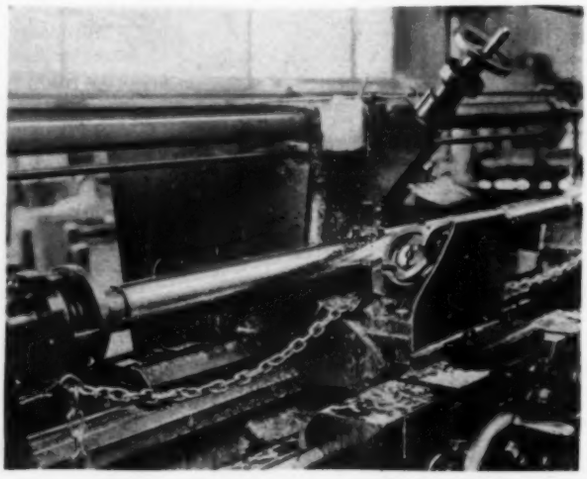
After the tube has been formed, the mandrel is lifted out of the die and the tube is stripped from it by hand. The largest press in the shop has but 24-in. clearance between the uprights, so it was necessary to mount the tools on an extension built far enough in front of the press to clear the uprights.

Turning With a Rotating Tool

HERBERT F. CRAWFORD

Oil well pump plungers are made of steel tubing turned to diameters suitable for the pump barrels in which they work. The Emsco shop in Los Angeles has devised a rotary cutter for this work which is used in connection with the substantial tool and follow rest shown. The tube is mounted on end plugs and driven through the spring coupling at the left.

The cutting disk has what is equivalent to a top rake and revolves as it feeds along the work. It cuts a long, curling chip and has a chip breaker in front of the cutter. In addition there is a stationary chain that, as the carriage feeds forward, sweeps the chips off the carriage into the pan.

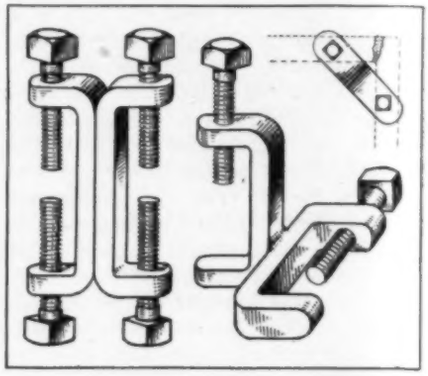


Clamps for Iron Workers

GEORGE A. LUERS
Consulting Engineer

In going through a structural-iron shop the other day, I saw some clamps that to me were unusual. Two kinds of clamps were in use. In one pair the backs were welded together in line, as shown at the left in the illustration. In the other pair the backs were welded together at a right angle, one at the bottom of the other, as shown at the right. In the right-hand upper corner of the illustration, one use of the first pair of clamps is indicated. Distance pieces of any required length can, of course, be welded between the clamps, either in line or at an angle, to fit them for special uses.

Such clamps are easy to prepare and there are many jobs in machine and welding shops where they will be found very useful.



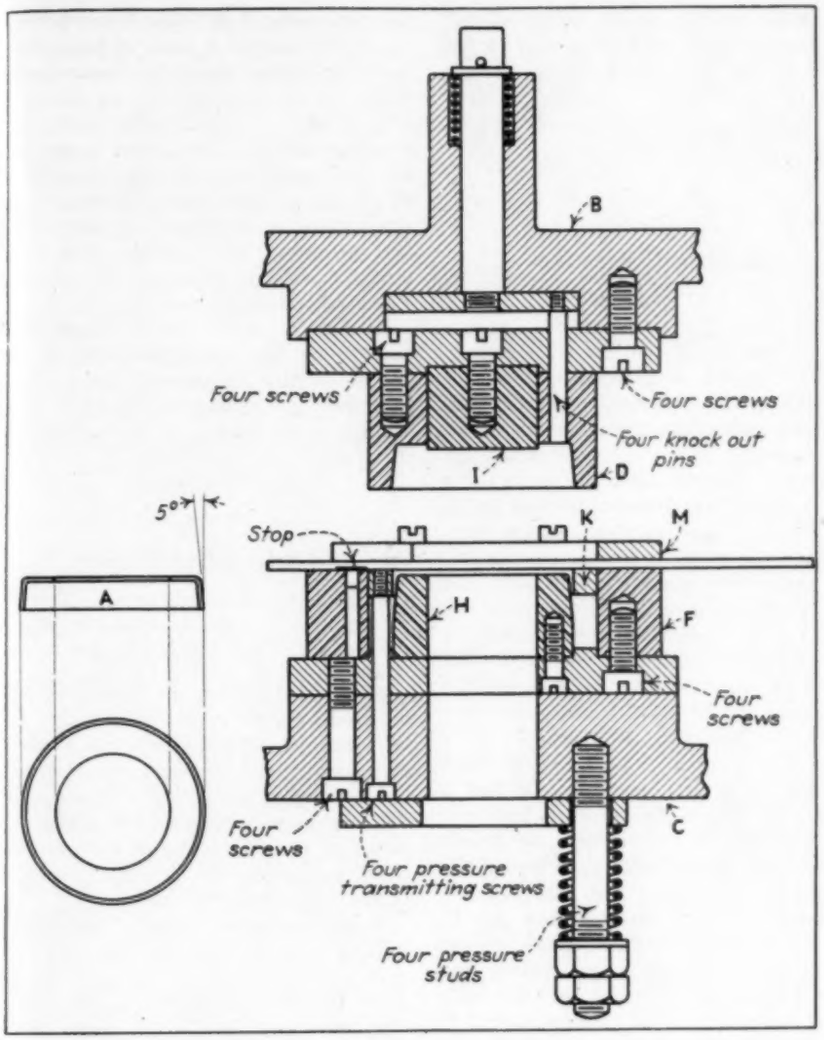
Combination Press Tools

BERTIL FALCK
Mechanical Engineer
Star Electric Motor Mfg. Company

A single set of press tools for making the shallow cup *A* at one stroke of the press is shown in the illustration. We have ten different sizes of these tools in use, all doing good work and giving satisfactory service.

Parts *B* and *C* are the upper and lower members, respectively, of a standard die-set. In operation, the blank is cut from the strip by the punch *D*, which is also the drawing die, and the die *F*. It is drawn over the drawing die *H*. The top of the drawing die is slightly lower than the face of the blanking die to permit clearance for blanking before the commencement of the drawing operation. As the drawing nears completion, the punch *I* pierces the work, the inside of the drawing die acting as the piercing die.

The spring-actuated ejector *K* also acts as the pressure ring. As the press



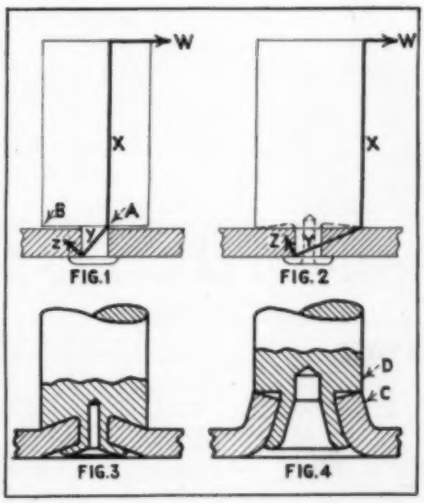
is an inclined one, an opening in the back of the stripper *M* permits the ejected work to slide off of the die. One would naturally expect that in piercing the work before the drawing was completed, the hole would be considerably enlarged. However, the enlargement is less than 0.001 in. in diameter. The stock is fed by hand and the production is approximately 500 per hour.

Squaring Studs in Sheet-Metal Bases—*Discussion*

HARRY SHAW
Consulting Engineer, Heywood, Lancashire, England

In an article under the title given above (*AM*—Vol. 76, page 680), Charles H. Willey states that he had trouble with studs riveted in sheet-metal bases by spinning, the riveting buckling the bases and throwing the studs out of square.

I have had similar trouble and presume that the difficulty was due to the

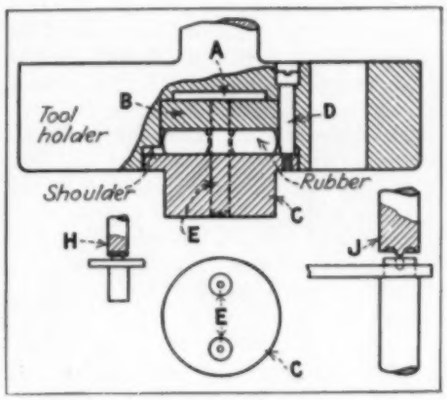


studs making contact with the flat metal only at the point *A*, Fig. 1, being prevented from touching at *B* by the rounded corner at *A*. If the shoulders of the studs are undercut at a slight angle, as in Fig. 2, the tendency for the base to buckle and the studs to tilt would be considerably reduced. The theory behind this may be of interest. If, in both cases, a force *W*, is pressing at the tops of the studs, the forces *z* and *Z*, tending to buckle the bases, are inversely proportional to the lengths *y* and *Y*, for approximately $WX = yz$ and $WX = YZ$. Hence, if the length *Y* is double that of *y*, the force *Z* tending to buckle the one base will be half the force *z* tending to buckle the other base.

Squaring Studs in Sheet-Metal Bases—*Discussion*

CHARLES F. KRAUT

In his article under the title given above (*AM*—Vol. 76, page 680), Charles H. Willey says he wonders if not a better way to fasten the studs so that they will not deform the bases. I



suggest that Mr. Willey modify his tools to square the studs and rivet the ends in one operation in a press.

In the anvil, the holes should be made deep enough to place hardened disks at the bottoms to resist wear and to firmly support the studs. In all other respects the lower members of the tools are to function as designed and described by Mr. Willey. The upper members should be modified as shown in the accompanying sketch. The toolholder should be rebored to receive the hardened backing plate *A*, the punch-holder *B*, the rubber pad and the leveling punch *C*, this latter member corresponding to the squaring punch in Mr. Willey's tools. All of these members are held in the toolholder by four screws, one only of which is indicated at *D*. The riveting punches *E* are to have their ends shaped to either of the contours indicated in the sectional portions *H* or *J*, as conditions warrant.

In operation, the studs are placed in the anvil and a base is placed on it with the stud ends passing through the holes in the bottom. As the ram descends, the lower members function as described

by Mr. Willey, the leveling punch *C* firmly holding the base. As the leveling punch recedes, due to compression of the rubber pad, the riveting punches come into action, forming heads on the ends of the studs. As the upper face of the leveling punch contacts with the shoulder in the toolholder, a leveling blow is delivered to the base while the studs are confined in accurate alignment. As the ram ascends, the lower members release the assembled product ready for removal.

Block for Holding Boring Tools

MALCOLM K. PARKHURST

The simple block illustrated was recently designed by the writer for holding boring and recessing tools in the lathe. Practically all details of construction and use of the device will be readily understood from the photographs. The center of the V-slot is accurately at the same height as that of the lathe centers, and since it is on the side of the block, round tools of any diameter are automatically lined up with the work center. The rigidity with which the tools are gripped will be appreciated in precision boring. The block is held to the compound rest by a single bolt in the center, the nut being in the T-slot usually occupied by the bottom of the toolpost.

While the device was designed for holding tools for boring and recessing, it serves equally well as a holder for screws when the heads are to be slotted. Regardless of the diameter, the screw is invariably at the center height of the slotting cutter. In holding screws for slotting, the block is, of course, turned at right angles from the boring position. In clamping tools or screws, the screws *A* are used for final tightening.

Equalizing Pressure of Vise Jaws

FRANCIS PAQUIN

While there are several methods of equalizing the pressure when clamping parts having slight variations in either thickness or diameter, none have appealed to me as much as those using wax. There are some objections to its use, but if applied under proper conditions it will give satisfactory results. If wax is used where the heat generated by the cutting tool and absorbed by the holding fixture is great enough to liquefy it, either enough coolant can be used to keep the fixture cool or the plungers can be packed with felt.

In the illustration is shown a pair of vise jaws adapted for holding four round pieces. The stationary jaw *A* has a series of V-slots for locating and centralizing the work. Holding pressure is applied by the movable jaw through the swinging clamps *B*, these clamps being pivoted to the movable jaw at *C*. Plungers *D* are a close slip fit in their respective holes and project slightly into the blind hole *E*, which is filled with wax and is closed by a screw plug. It will readily be seen that by closing the vise in the conventional manner, that the pressure on the plungers *D* will be equalized by the wax and that the four pieces of work will be held with equal pressure, notwithstanding slight variations in diameter.

Before we made the jaws described, we made a test block having two plungers, using it in an ordinary bench vise. We clamped a piece of paper between one plunger and the stationary jaw, while with the other plunger we clamped a piece of ¼-in. cold-rolled steel, the plungers adapting themselves nicely to the different thicknesses. After that test, we placed the block under the ram of an arbor press and applied all the pressure possible. None of the wax was forced past the plungers, which had liberal clearances in their holes.

In making devices of this kind, the part to be filled with wax should be heated slightly to prevent the molten wax from congealing too quickly and leaving an air pocket at the bottom of the hole.

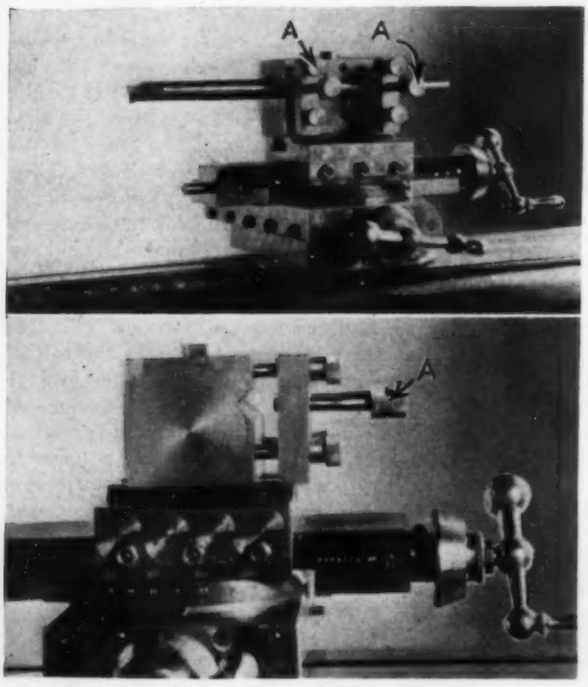
A Light Idler Pulley

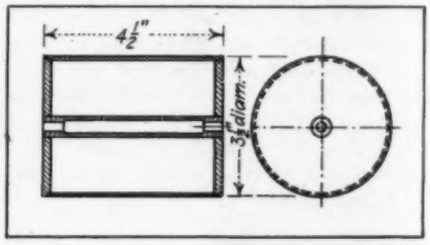
D. J. REYNOLDS

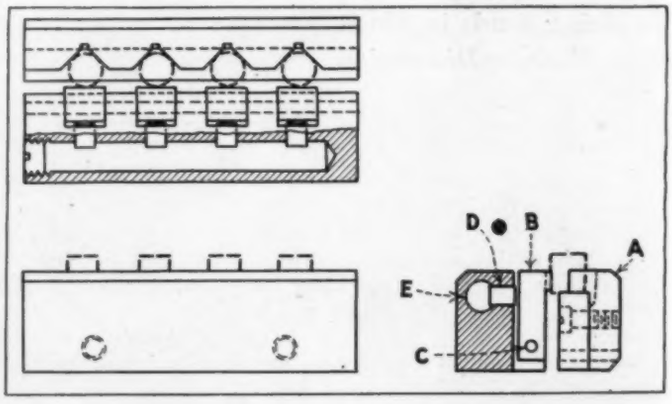
Draftsman, Kelly Koett X-Ray Manufacturing Company

A recent type of electrical machine required an idler pulley over which an endless ribbon of silk was to run at very high speed. The ordinary type of wood, paper or metal pulley was so heavy that the inertia in starting and stopping resulted in the destruction of the silk ribbon. To remedy this difficulty, the light pulley illustrated was made.

A Bakelite tube having a wall thickness of 1/16 in. was used for the rim and was held in position by disks of 3/16 in. thick Bakelite at the ends. The outsides of the disks were turned off for ⅛ in. of their thickness to be a tight fit on the inside of the Bakelite







tube. The hub, or bushing, was of brass and its outer diameter was turned for a press fit in the holes in the Bakelite disks.

In assembling the pulley, the bushing was pressed into one of the disks. Then the tubing was put in position and the disks were pressed into place. This construction made a light but rigid pulley that was practically in running balance without correction. Stock materials were used and no special tools were required.

Localizing Copper Plating

D. L. BROWN

In order to carburize the inner surfaces only of the roller-bearing cups shown at *A* in the illustration, all other surfaces are given a protective coating of copper by electroplating. In the carburizing operation, the carbon will not penetrate the copper coating, so that all surfaces so coated will be left soft in the hardening process.

The cups are strung on a brass tube and are kept apart by paraffined blocks of wood faced with rubber, being tightly confined by the knob nut *B* and the handle nut *C*. Brass washers having flat springs are attached to the blocks and make electrical contact between the work and the tube on which it is strung. The rubber pads seal the inner surfaces of the cups and prevent the plating solution from entering. Two tubes holding fifteen cups each are placed in the bath, being suspended from the cathode bars by hooks. Suspended from the anode bar, the anodes *D*, of flat copper bars, hang between the loaded tubes, as indicated in the end view of the plating tank.

SEEN AND HEARD

JOHN R. GODFREY

Ask the Maintenance Man

It sometimes happens that a machine repair man, as a result of several years machinery in operation, can offer valuable information to the designer of tools. One repair man in a large plant recently observed that most of the operating troubles were caused by insufficient chip clearance. It was necessary, on many machines, to shave and cut here and there to prevent the chips from clogging the indexing devices and other working parts.

Normalizing Castings

In spite of extra hard cutting tools some shops are finding it advisable to normalize all castings before machining. Even small units that do not require extreme accuracy are normalized to save damage to tools from striking hard spots. Normalizing, to relieve stresses and aid in machining, should be just above the critical point, which is above the temperature used in annealing. Some of the large shops find that this pays dividends in the shape of lowered tool costs.

Abused Machinery

Visiting a large production shop in a midwestern city a superintendent of a small but well-run plant, was horrified to see the condition of the equipment. Three years ago the plant was built and equipped with the best that could be obtained in modern machinery. Today, as a result of what appears to be a short-sighted policy on the part of the management, this equipment looks as if it had been through several wars.

The answer is not hard to find. Because of the stress of the times and the attempt to keep down costs, the policy has been adopted of not paying more than 45 cents an hour for machine operators. Such wages have not attracted good mechanics and the company has been forced to hire "farmhands." Lacking not only experience but the craftsman's appreciation of the machine, these yokels punish the machines until a major failure occurs. With wobbly toolposts and spindles out of line, inspection costs mount and rejections pile up.

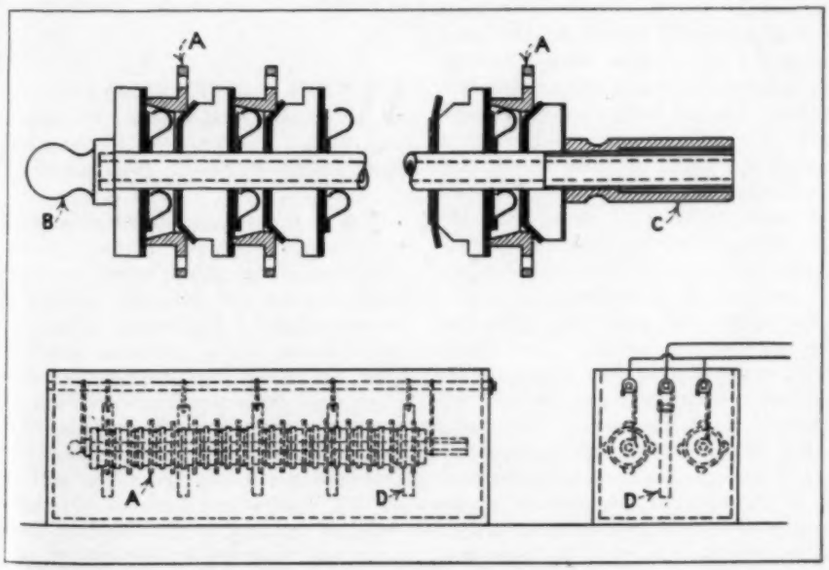
It's not the operator's fault. Management at the top is responsible for the policy of saving direct labor costs at the expense of machinery that's being worn out much more rapidly than its depreciation rate. With adequate supervision and a fixed maintenance program, it might be possible to get by under these conditions, but where both are lacking the situation is deplorable. Our visiting superintendent almost broke down and cried.

Cutting Oil—Fact and Hokum

Lubricants, both for cutting and for bearings, remain more or less of a mystery and are consequently subjects for more hokum than most anything else we use in the shop. Putting a new label on an old oil has been known to improve its quality—and putting really good oil into a can that has contained poor stuff has given it a black eye. Nevertheless there is good evidence of a real difference in results from the use of oils, even if we don't know just why. According to tap experts almost any lubricant with a high sulphur base will cause taps to cut considerably over size. And in many cases the cutting of a satisfactory thread depends largely on the oil used, if this same tap expert is correct. Imagination and prejudice play a large part in many things and oil seems particularly susceptible.

Tap Grinding

Most tap failures can be traced to faulty grinding—faulty because of two reasons: lack of knowledge of how to grind the tap on the part of the operator, and lack of adequate equipment. How many shops try to get by on a $80 motor-driven grinder with a ¼-in. axial spindle float! A tap is a precision cutting tool. The grinder doesn't necessarily have to be expensive; all that is required is a true-running, ball bearing spindle and a wheel that is dressed accurately with a diamond. Given such a set-up, fully satisfactory results can be obtained by hand methods.



· NEW BOOKS ·

APPRENTICESHIP, ITS PRINCIPLES, RELATIONSHIP AND PROCEDURES—*By Stewart Scrimshaw, Professor of Economics & Industrial Relations, Marquette University. 273 pages, 5½x8 in. Published by McGraw-Hill Book Co., Inc., New York. Price, $2.50.*

This volume, as pointed out in the preface, attempts to review the meaning of apprenticeship in its relation to modern industry and to present its status with reference to labor. It shows its relation to the employer and with formal education, as well as its relation to the functions of the state itself. It also includes some of the problems of state administration which have been encountered in the Wisconsin plan, these being presented because they show principles and procedures that must be recognized if a thorough knowledge of industrial training is to be obtained, and particularly if this training is to be subject to any form of state control. The author feels that apprenticeship is more necessary in present-day industry than before the introduction of mass production machinery. The relations between apprenticeship and modern industry, with organized labor and with the employer, are carefully considered. There is also a discussion of the limitations and advantages of employers' apprenticeship administration, of apprenticeship and the schools which include part-time vocational schools, the effect on the boys, the principles of cooperative vocational education and some of the problems in connection with it. The Wisconsin plan receives considerable attention as does also the special problem of state administration.

BLUEPRINT READING FOR THE MACHINE TRADES—*By Robert H. Fortman, head of mechanical engineering department, and James McKinney, educational director, American School. 154 pages, 5x8½ in. Indexed and illustrated. Clothboard covers. Published by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Price, $1.50.*

Every shopman should be able to make good mechanical drawings, for with the ability to make them comes the ability to interpret them swiftly and accurately. But there are often reasons why workmen cannot learn drafting, and it is for these men that this text is planned. It is a practical handbook on reading of working, assembly, scale, manufacturing, tool and installation drawings, endeavoring to give instruction in a series of simple steps, each step having examination questions.

Chief virtues of the volume are its non-technical phraseology, easy style and the clarity of its illustrations. Nineteen tables list standard dimensions for bolts, screws, rivets, keys and other essential tool parts.

BIBLIOGRAPHY ON STANDARDIZATION. — *Compiled by Anne L. Baden, division of bibliography, Library of Congress. 19 pages, 6x9 in. Paper covered. Bureau of Standards Miscellaneous Publications No. 136. Available from Superintendent of Documents, Washington, D. C.*

This bibliography on standardization is supplementary to the list printed in the Standards Yearbook during the past four years. It comprises references to general literature on standardization of specific commodities.

AN INTERNATIONAL ENQUIRY INTO COSTS OF LIVING—*A comparative study of workers' living costs in Detroit and fourteen European Cities. 290 pages, 6x9 in. Paper covers. Published in the United Kingdom for the International Labor Office of the League of Nations. Twentieth Century Fund, Inc., 11 West 42d Street, New York, N. Y. Price $2.00.*

This book embodies the report of the committee that investigated the question of what a comparative rate of wages would be between the Detroit plant of the Ford Motor Company and the various new European plants that were or are being opened by the same company. The report shows that, of the fourteen European cities considered, the cost of living for the worker is highest in Stockholm, Sweden, and lowest in Barcelona, Spain. It also shows that in order for these two cities to maintain the same standard of living that Detroit does, the workman's earnings must increase 50 per cent in Stockholm, and 144 per cent in Barcelona.

In general, the report does not draw any specific conclusions. The figures show, however, that low wages are not correlative with low prices, or that high wages do not necessarily bring high prices. In Stockholm, for instance, the cost of living is approximately the same as in Detroit, but the prevailing wage is only two-thirds that of Detroit.

The report as a whole is interesting, and perfectly clear where conclusions are given in terms of a common denominator, such as percentages or dollars. In other places, the difference is not so easily understood because the prices of things are given in the money values of the country quoted. All reports of this nature would be much more intelligible and readable if the costs were also given in terms of a common denominator, which in this case would be prices in terms of labor hours.

INTERNATIONAL UNEMPLOYMENT. *A Study of Fluctuations in Employment in Several Countries from 1910 to 1930. 496 pages; 6x9¼ in. Contributed to the World Social Economic Congress and edited by M. L. Fledderus. Published by the International Industrial Relations Institute. The Hague, Holland. Also obtainable at 130 East 22nd St., New York. Price, $2.50.*

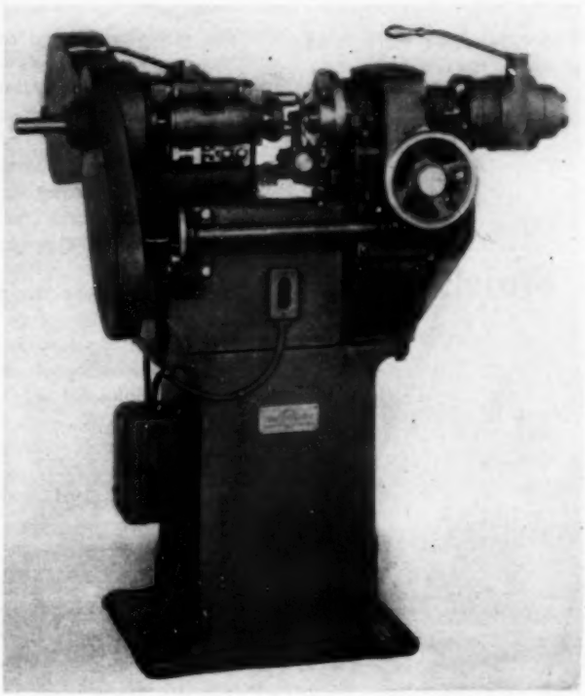
This volume is the forerunner of a second on World Social Economic Planning, and deals with the problem now uppermost in all countries, unemployment. The complexity of the problem is well stated in the introduction: "Unemployment is a symptom rather than a definite entity recurring in unchanged form. Each period of unemployment in the different countries has presented different aspects . . . which vary in their relative importance and combined, make up a different set of circumstances in each recurring depression." The reports include Australia, Canada, China, France, Great Britain, Holland, United States and Russia, both under the Czar and the Soviets.

It is impossible to give an adequate idea of the data in such a volume in a brief review. The reports of each country are of interest and of great value to students of our greatest problem.

WOOD PATTERNMAKING—*By Herbert J. McCaslin. 311 pages. 4¾x7½ in. Published by McGraw-Hill Book Co., New York. Price, $2.25.*

This is the second edition of a small but comprehensive text book on a subject that is far more important than might be assumed from the number of books available. The reason is perhaps to be found in the fact that practices have not changed as much as in other lines, since patternmaking is not a mass production operation. This edition contains both revisions and additions to the problems previously given and a total of 351 illustrations make it of special value to teachers and students. Questions and footnotes are features.

SHOP EQUIPMENT NEWS



Reed-Prentice Horizontal Milling or Routing Machine

While designed primarily for shell ring work in government arsenals, the horizontal milling or routing machine developed by the Reed-Prentice Corp., Worcester, Mass., is adapted for other classes of horizontal milling work of the interrupted groove type, and is offered for use where a small self-contained and compact unit is desired for rapid production on work of different diameters.

The machine is of the motor-driven floor-type with a power-driven head and spindle. The latter has a collet chuck for holding the cutter. Automatic feed is provided to the power-driven rotary head, which also has an adjustable stop to throw out the feed at any predetermined point. The motor employed is of the ball-bearing type and is specified for 440 volts, 60 cycle, 3 phase, 1,200 r.p.m., and has push-botton control. A handwheel provides hand rotation of the head. The hand-operated chuck holds the ring in the position located by a pin.

Speeds of 4,000, 4,500, 5,500 or 6,000 r.p.m. may be secured from the cutter spindle which runs continuously. The lever-operated collet-type chuck operates the jaws for the holding ring. The sliding head of the spindle is operated by a lever and is brought to the proper depth of cut by micrometer adjustment, and is held in position by a latch. Rotary feed for the workholding fixture is engaged by a plunger-type lever, and the handwheel provides hand feed rotation of the head. At the end of the cut an adjustable stop on the rotating fixture disengages the latch, and the sliding head of the spindle is automatically withdrawn from the cut. This withdrawal is operated with a counterbalance with self-contained dashpot. This allows removal of the work by the operator while the rotating fixture continues to revolve to the starting position for the next piece, when an adjustable dog stops the feed automatically. The cutter spindle is guarded while the operator loads and unloads. One man operates two machines.

Both the spindle and sliding head of the machine are of the ball-bearing type, and are the same as used on the company's No. 2V vertical miller. A brake is provided for the locking spindle while changing the cutter or collet. The motor drives through two V-belts and the feed is driven by two V-belts so that two speeds and feeds are provided, while separate change gears accommodating the drive to the workholding fixture can be supplied for additional feed changes. Approximate weight of the machine is 1,187 lb.

Waldron Silent Steel Gears

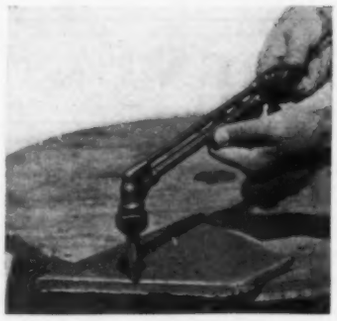
All-steel gears and gear blanks manufactured by the John Waldron Corp., New Brunswick, N. J., feature silent service and self-lubrication. These gears are built up of many thin pieces of sheet steel, coated with graphite and subjected to pressure. They have the appearance of a ground steel gear of ordinary construction. In service they take on a smooth glass-like polish on the teeth. These gears may be run in mesh with each other, or they may be run in mesh with any gear commonly used as a mating gear for silent pinions. The company is prepared to furnish these gears cut to any specifications or to furnish gear blanks. Bulletin No. 71 gives complete cutting instructions and engineering data. Bulletin No. 70 describes the gear and presents an experiment for demonstrating the silence of the gear.

J.B.R. Welded Cutting Tools

Long life between grinds is claimed for a line of tipped cutting tools now being distributed in this country by Cadway, 489 Fifth Ave., New York, N. Y. This product was developed by The Rennie Tool Co., Ltd., Manchester, England. It consists of a cobalt alloy which is welded by an exclusive process to carbon steel shanks.

It is said that the alloy has properties somewhere between those of high-speed steel and tungsten carbide and combines

toughness with a high degree of hardness. The shanks are recessed at an acute angle to receive the tips, thus obtaining a backing approximately normal to the cutting pressure. A wide variety of shapes and sizes is available.



"Money Saver" Cutting Attachment for Welding Torches

The Smith Welding Equipment Corp., 2619-33 Fourth St., S.E., Minneapolis, Minn., has placed on the market a new cutting assembly or attachment for a welding torch. The cutting oxygen valve is a triple-thread, screw valve with knurled thumb wheel, so arranged that it can be quickly opened and closed with the thumb. The cutting tip automatically evens up the flames. Simplified construction and reduced cost are features of this assembly, which has been approved by the Underwriters' Laboratories.

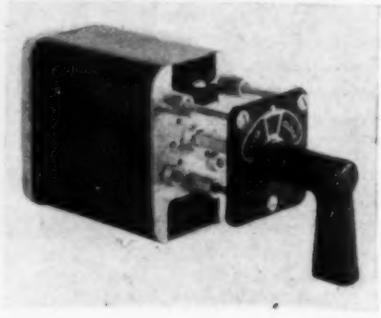
Colburn Hydraulic-Feed Finish Boring Machine

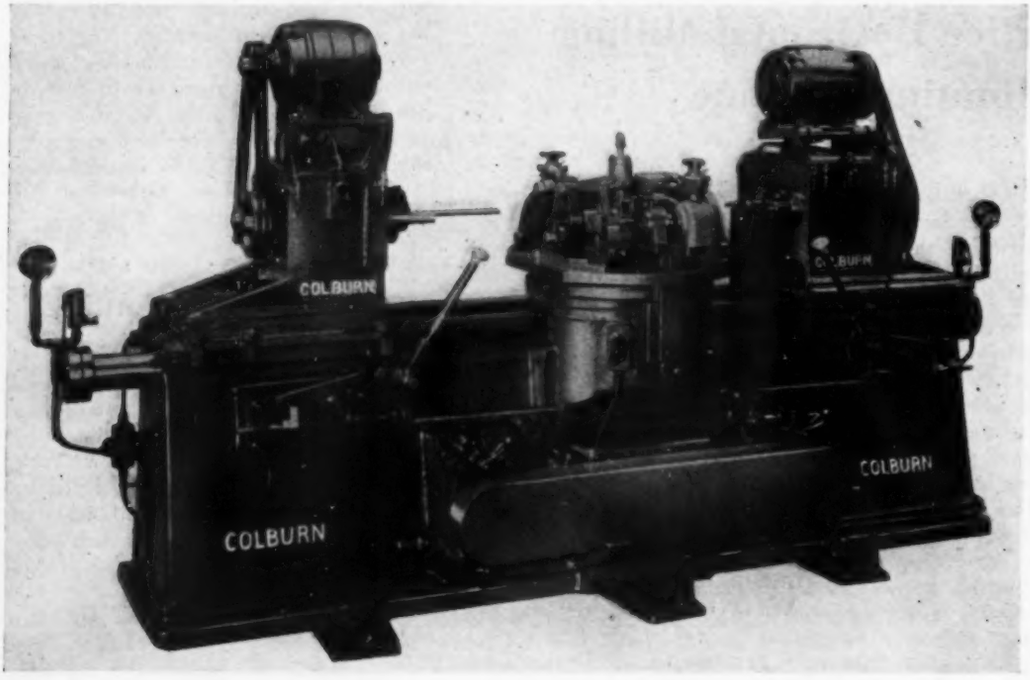
For precision boring, the Colburn finish-boring machine, developed by the Consolidated Machine Tool Corp. of America, Colburn Division, Rochester, N. Y., uses either diamond or tungsten-carbide tools and has hydraulic feed. The machine is designed for rapid production of small parts of cast-iron or non-ferrous metals. As illustrated, it is equipped with five spindles, three in the right-hand head, and two in the left-hand head. Five straight holes are bored in three different parts. Indexing the table, starting the cycle, and unloading are the only manual operations required. The number of spindles and type of indexing table furnished depends on the nature of the job, production required, and variety and size of the parts to be finish bored.

It is said that by feeding the heads instead of the table it is possible to get practically twice the production since all spindles in both heads are working simultaneously, during which time the second set of fixtures is being unloaded and loaded. Hydraulic equipment is employed for the feed and traverse of the spindle head and is driven by a single motor. Motors driving the spindle heads are balanced and drive through multiple V-belts. Spindle speeds up to 2,620 r.p.m. are furnished, and this machine gives cutting speeds up to 300 ft. per minute.

General Electric SB-1 Switch

A compact, inexpensive switch for electric operation of circuit breakers, governors, rheostats, and instrument transfer has been developed by the General Electric Co., Schenectady, N. Y., and designated as Type SB-1. Various combinations for different applications are made up by means of interchangeable parts. Features are: Positive silver-to-silver contacts; ease of fastening all connections with screwdriver; ample room for connecting leads; red or green mechanical target to indicate the last operation of the breaker control switch; small panel space; and the use of distinctive handles for different styles.





Small parts of cast iron or non-ferrous metals are finish bored on this Colburn hydraulic-feed machine, which feeds the heads instead of the table for faster production

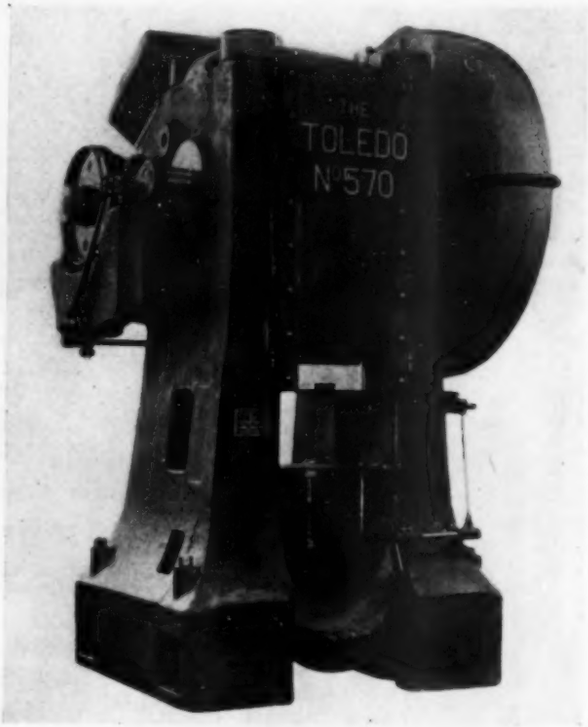
Improved Toledo Heavy-Duty Presses

The line of heavy-duty presses built by Toledo Machine & Tool Co., Toledo, Ohio, has been improved lately in several respects. An accompanying illustration shows the front view of one of these presses supplied for heavy squeezing, embossing and sizing operations. The frame is of a single steel casting of heavy cross-section reinforced by four extra large steel tierods shrunk in place. Legs or supporting blocks are unusually heavy. They are used only when no pit is wanted.

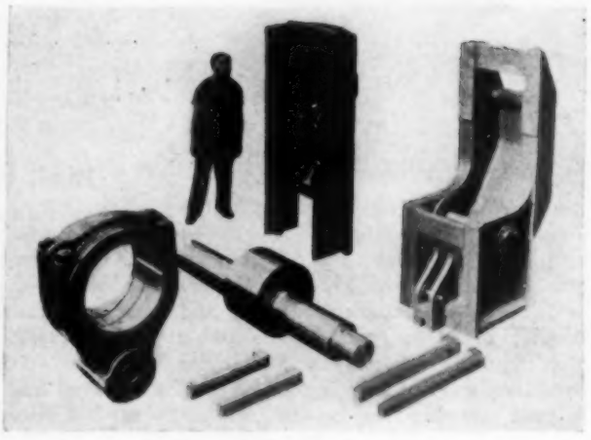
The crankshaft is of the full eccentric type and is of large diameter. It is made of special steel, heat-treated and normalized, and there is no adjustment in the steel connection, making solid metal between the crank and the slide. A wedge adjustment is provided under the bolster. All bearings are bronze-bushed.

The slide is a steel casting guided in the front by bronze-faced gibs. There are four taper bronze gibs set in the frame in the back of the slide. These gibs permit adjustment to take up for possible wear and to insure alignment of the slide.

The press is arranged for receiving a lower cam-actuated knockout and an upper knockout. Single gearing is used so that the press may be operated at a high rate of speed considering the size. Cut steel herringbone gears are employed. These are incased in a cast-iron gear guard containing lubricant. Control of the press is by a multiple-disk friction clutch with independent brake on the backshaft, and the operating mechanism is air-controlled by a treadle. This mechanism is so arranged that the press may be operated continuously and stopped at will, or by making a slight adjustment the press will make one cycle for each depression of the treadle and stop at the top center. A 30-hp. motor is mounted on the top of the frame and connected direct to the flywheel by means of V-belts.



Supplied to an automotive manufacturer, this press features heavy supporting blocks, frame of a single steel casting, large-diameter, full eccentric crankshaft and slide made from a steel casting



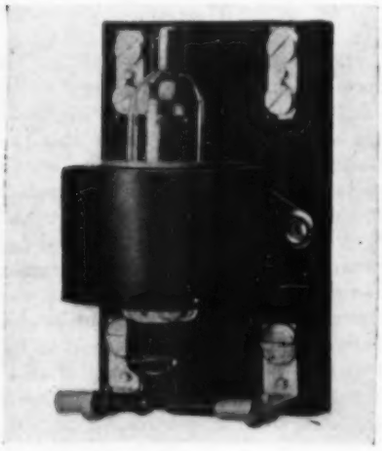
Pictured below are the full eccentric crankshaft, exceptionally long cast-steel slide, the four gibs, and non-adjustable steel connection

"Diamond H" Magnetrole Relay

Motor and light control, time and temperature control, signal equipment, and photo-electric cell operation are uses of the "Diamond H" magentrole relay developed by the Hart Manufacturing Co., Hartford, Conn. The relay requires an operating current of 5 watts as a maximum for the 10 and 20 amp. sizes. There is no exposed arc, and the device will operate continuously up to 120 operations a minute. Mounting position is not critical, and the tube will work satisfactorily if tipped at an angle of 25 deg.

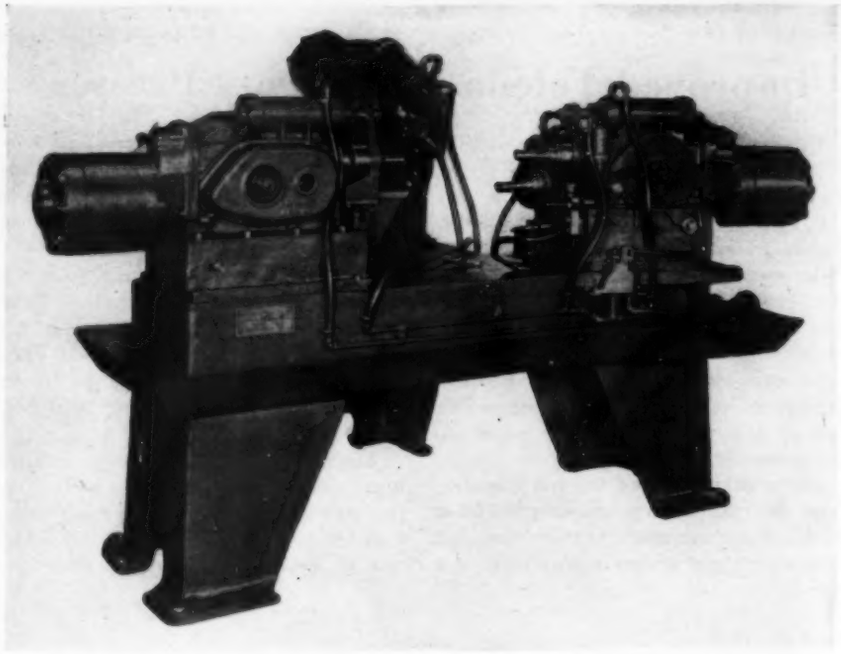
The relay incorporates a glass tube, inside of which there is a porcelain cup separating two concentric pools of mercury. Each of these pools is connected to terminals at the bottom of the base. Surrounding the porcelain cup is a metal cylinder having magnetic properties, so arranged that when moved it will displace the mercury in the outer pool and complete a mercury-to-mercury contact. The action of this cylinder is controlled by a solenoid on the outside of the tube.

Two capacities offered are 10 and 20 amp., 250 volts. The relay can be furnished, however, in all voltages from 6 to 220.



Millholland Four-Way Drilling Machine

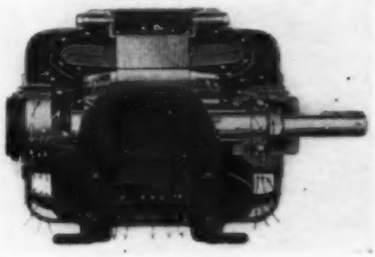
The Millholland Corp., 1145 E. 22nd St., Indianapolis, Ind., has developed a four-way drilling machine for drilling angular holes in small forgings, in which it is desired to obtain extreme accuracy of location and to eliminate the straightening operation after drilling. The forging is first coined to set the hole bosses in correct position. When the piece is placed in the fixture, the bosses fit against pads which prevent springing when the holes are drilled. An air valve starts the feeds on all the drilling units simultaneously, and these units go through their cycle independently and then stop. Four units are employed, and the mounting bases holding them are made to correct height and proper angle, using a master locating block. The machine can be constructed for a number of different set-ups, and positions of the drilling unit can be changed by relocating them on the bed or by substitution of other mounting bases.



General Electric Splash-Proof Induction Motors

Splash-proof induction motors, announced by the General Electric Co., Schenectady, N. Y., incorporate end shields of special construction, the top half being solid to exclude dripping water and liquids. Cooling air enters through ventilating openings in the bottom half of the end shields, a special baffle, which extends to the center line of the motor shaft, preventing the entrance of splashing water into the windings.

The motor frame is protected against the entrance of dripping water and liquids by a one-piece cover, which is fitted to the motor frame. A water-tight conduit box protects the motor leads.

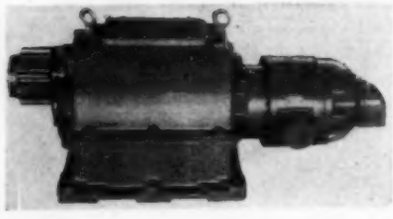


General Electric D.C. Motors

D.c. motors of improved design have been announced by the General Electric Co., Schenectady, N. Y. These motors are so designed that many variations, such as different degrees of inclosure for various applications, can be accomplished by using only a few different parts. Improved pulley end-shields afford maximum protection to the motor windings. Drop-forged feet welded to the motor frame reduce the possibility of breakage. Insulation employed is resistant to moisture and weak acids. Speeds of all constant-speed motors can be increased 25 per cent by field control.

Allen-Bradley Bull. 609 Starting Switch

A manually operated starting switch for small a.c. motors has been developed by the Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis. This Bulletin 609 switch has two overload relays, and tripping of either opens the contactor and completely disconnects the motor from the line. Either relay can be reset without opening the switch cabinet.



Size 1 has three poles, and Size 2 has three and four poles. The Size 1 switch will handle self-starting single-phase motors up to 1 hp., 110 volts, 2 hp., 220 volts, and polyphase motors up to 2 hp. at 220, 440, and 550 volts. The Size 2 switch is rated at 5 hp., 220 volts, and 7½ hp., 440 and 550 volts, for 2 and 3-phase motors.

Link-Belt Motorized Speed Reducer

A motorized speed reducer has been added to the line of inclosed speed reducing units built by Link-Belt Co., Philadelphia, Pa. The reducer illustrated is a triple-reduction unit with a speed ratio of 312.2 to 1. The advantages of using a motor with extended

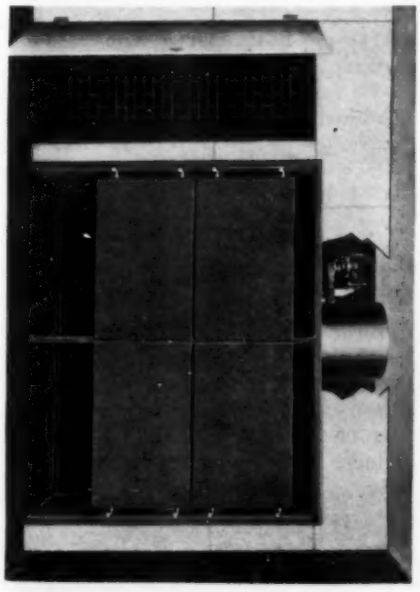
shaft and mounting it in this manner are: increased efficiency, compactness, reduced floor space, and elimination of high-speed motor-shaft coupling. Roller bearings and continuous-tooth herringbone gears are used in the speed reducer.

"Armco" Crystal-Etched Enameling Iron

Greater adhesion between the enamel and the iron is claimed for the "Armco" crystal-etched enameling iron developed by the American Rolling Mills Co., Middletown, Ohio. Reboiling behavior is improved, and imperfections, such as black specks, are reduced.

De Vilbiss Exhaust Chamber for Spray Finishing Departments

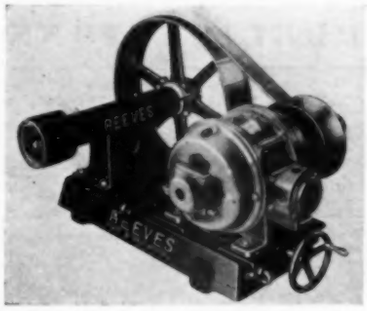
An exhaust chamber for use in rooms which are already fireproof has been announced by the De Vilbiss Company, Toledo, Ohio. The chamber is designed to provide a means for mounting the exhaust fan and to distribute the exhaust properly where a complete spray booth is not required or where an exhaust fan mounted in the wall or window will not adequately take care of the requirements. It is actually the back section of a standard spray booth. It is placed in the rear of the room and the exhaust pipe is run outside. The space around the chamber may be filled in flush in the front with sheet metal, or other non-inflammable material, with a door providing access to the exhaust fan. Three widths, 8, 10 and 12 ft. are available. All sizes are 32¼ in. deep and 7 ft. high.

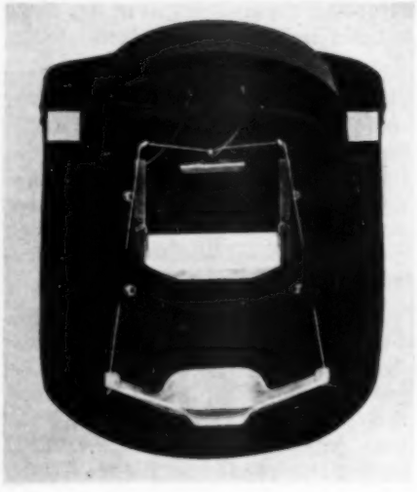


Reeves Vari-Speed Motor Pulley Countershaft Unit

An adaptation of its "Vari-Speed" motor pulley has been developed by the Reeves Pulley Co., Columbus, Ind., in the form of a "Vari-Speed" motor-pulley countershaft unit. This unit embodies a standard Vari-Speed motor pulley, which consists of two opposing cone-faced disks, one stationary and one sliding, and an adjustable power compression spring, all mounted on the shaft of a standard motor. This assembly is mounted in turn on a special sliding motor base. A V-belt forms the connection between the sliding disks and the driven pulley. A turn of the adjusting hand wheel in one direction moves the motor and disk assembly toward the driven pulley; in the other direction, away from it. As the motor pulley moves away from the driven pulley, the sliding disk moves out laterally, and the V-belt assumes and travels over a smaller diameter between the disks, thus effecting the speed reduction.

The countershaft unit also employs a special ball bearing countershaft, at one end of which is a flat-faced pulley. This pulley receives power from the Vari-Speed motor pulley and motor. On the other end of the countershaft any standard type of drive, such as pulley, multi-V-belts or chain and sprocket can be applied to transmit the power. The countershaft itself is adjustable on the base proper. The unit is built in seven sizes from fractional to 7½ hp.





Lincoln Head Shield for Welding Operators

A movable protective lens which allows the operator clear vision without raising the shield is embodied in the "Weld-Fast" head shield announced by the Lincoln Electric Co., Coit Rd. & Kirby Ave., Cleveland, Ohio. The movable protective lens permits both hands of the operator to be free at all times so that welding can progress with but few interruptions. The lens is held in place in a vertical slide by a spring, and slight pressure with the chin on an aluminum rest raises the lens and permits the operator to view the work or change electrodes. When pressure is removed, the lens falls back automatically into place. A stationary cover glass guards the inner lens against spatter.

Westinghouse Fractional-Horsepower Motors

Development of a capacitor motor and the redesign of the older types of small motors has been undertaken by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Interchangeability in small motor manufacture has been sought. Frames, shafts, bearings and mounting arrangements are interchangeable, rating for rating. Five frame sizes suffice to serve the entire line, ranging in output from 1/30 to ¾ hp. Types included in redesign are: split phase, capacitor, repulsion-induction, polyphase, direct current and repulsion motors. A feature of the capacitor-type motor is the resilient spring mounting which nullifies vibration. This type of motor is particularly used for refrigerators, oil burners and stokers.

Parker-Kalon Cold-Forged Wing Nuts

Cold-forged wing nuts are now being produced by the Parker-Kalon Corp., 200 Varick St., New York, N. Y. These wing nuts are claimed to be free from flaws, roughness and other imperfections and are so shaped as to provide ample finger grip for drawing them up tight. Holes are centrally located and punched. The base of the nut is smooth and square so that it will draw up tight and flush with the work.

• PATENTS •

JULY 12, 1932

Metal-Working Machinery

Metal Working Press, Rudolph W. Glasner and Fredrich J. Rode, Chicago, Ill. Patent 1,866,595.

Automatic Machine for Arc Welding. Robert Sarazin, Neuilly - sur - Seine, France. Patent 1,866,675.

Torch Cutting Machine. James L. Anderson, Tenafly, N. J., assigned to Air Reduction Co., Inc., Patent 1,866,695.

Forming Apparatus. John Maier, St. Louis, Mo. Patent 1,866,895.

Torch Cutting Machine. James L. Anderson, Tenafly, N. J., assigned to Air Reduction Co., Inc. Patent 1,867,047.

Hydraulic Back Rest for Grinding Machines. Amos P. Steiner and Harold E. Balsiger, Wayesboro, Pa., assigned to Landis Tool Co. Patent 1,867,112.

Machine for Polishing or Grinding Cam Tracks and Like Sinuous Surfaces. John George Douglas, Leagrave, Luton, England. Patent 1,867,213.

Forging Machine. Thomas C. Sheehan, Upper Montclair and John E. Drew, Jersey City, N. J., assigned to Wade & Butcher Corp. Patent 1,867,331.

Tools and Attachments

Centering Device for Punch Presses. Clifford H. Glaze, Long Beach, and Claude I. Brown, Compton, Calif. Patent 1,866,704.

Self Opening Die-head. Royce M. Strickland, New Haven, Conn., assigned to The Geometric Tool Co. Patent 1,867,192.

Automatic Feed Mechanism for Punch Presses and the Like. Joseph Wittek, Chicago, Ill. Patent 1,867,343.

Tool Post. Rudolf von Frommer, Budapest, Hungary. Patent 1,867,482.

Processes

Method of Producing Metal Working Tools. Leroy B. Monosmith, Rockford, Ill., assigned to The Ingersoll Milling Machine Co., Rockford, Ill. Patent 1,867,021.

JULY 19,1932

Metal-Working Machinery

Machine Tool. Charles B. De Vlieg, Rockford, Ill., assigned to Sundstrand Machine Tool Co. Patent 1,867,616.

Method of and Machine for Generating Worm Gear. Nikola Trbojevich, Highland Park, Mich. Patent 1,867,782.

Screw Machine (Movable Latch). John A. Arenz, Mount Vernon, N. Y., assigned to International Screw Co. Patent 1,867,796.

Electric Upsetting Apparatus. Giuseppe Benedetto, Novara, Italy, assigned to The Omes Holding Co., Ltd. Patent 1,867,935.

Electric Upsetting Apparatus. Giuseppe Benedetto, Novara, Italy, assigned to The Omes Holding Co., Ltd. Patent 1,867,936.

Machine for Mill Cutting Single Point Double Thread Screws. John A. Arenz, Mount Vernon, N. Y., assigned to International Screw Co. Patent 1,867,995.

Milling Machine. Newman M. Marsilius, Bridgeport, and Oswald A. Olsen, Stratford, Conn., assigned to The Producto Machine Co. Patent 1,868,016.

Boring Machine and Method. Ewald A. Arp, Minneapolis, Minn. assigned to Van Norman Machine Tool Co. Patent 1,868,440.

Tools and Attachments

Indexing Attachment for Automatic Machines. William J. Richards, Waterbury, Conn., assigned to The Bristol Co. Patent 1,867,592.

Processes

Manufacture of Shaped Metal Articles. William Mackie, Glasgow, Scotland. Patent 1,868,213.

• TRADE PUBLICATIONS •

COPPER. United States Metals Refining Co., 420 Lexington Ave., N. Y., N. Y., has published a booklet on high-conductivity oxygen-free copper, which permits greater reduction in area and elongation than ordinary commercial copper.

EVERDUR METAL. The American Brass Co., Waterbury, Conn., is distributing a booklet "Everdur Metal"—Publication 32101—on the applications of this metal to tanks and pressure vessels.

FIBRE. A four-page folder describing the fabricating of hard vulcanized fibre and of laminated phenolic materials has been issued by the Spaulding Fibre Co., Inc., Tonawanda, N. Y. This folder presents information on the shearing, sawing, punching, turning, drilling, threading, tapping and forming of these materials.

INDUSTRIAL RUBBER GOODS. A condensed catalog giving a comprehensive line-up of principal industrial rubber goods manufactured by the B. F. Goodrich Company, Akron, Ohio, has just been published. It is entitled "Engineering Data, Industrial Rubber Goods," and describes belting, conveyor belts, and many other rubber products.

LEATHER BELT DRIVES. Alexander Brothers, Inc., 14 South St., Philadelphia, Pa., has published a booklet entitled "Alexander Leather Belt Drives," presenting modern engineering data on leather belt drives, comprising 32 8½ x 11 in. pages, including tables.

LEATHER BELT RATING TABLES. The Graton & Knight Co., Worcester, Mass., has published "Research Leather Belt Rating Tables for Economical Power Transmission," Second Edition. It describes the advantages of its "Research" belting, and gives tables for belt selection.

MOTORS. Bulletin GEA-1619, issued by the General Electric Co., Schenectady, N. Y., describes splash-proof motors for squirrel-cage induction types.

PUNCHES AND SHEARS. Bulletin No. 79, published by the Niagara Machine & Tool Works, Buffalo, N. Y., describes lever punches and lever shears for sheet metal working.

RAILROAD INFORMATION. The Committee on Public Relations of the Eastern Railroads, 143 Liberty St., New York, N. Y., has issued the 1932 "Year Book of Railroad Information."

SPEED REDUCERS. Winfield H. Smith, Inc., Springville, Erie Co., N. Y., has available Catalog No. 27, describing in detail recent additions and improvements in its line of speed reducers and transmission machinery. It provides quick reference in selecting speed reducers of 5 hp. capacity or less.

VALVES. Bulletin D-445-S2, published by the Worthington Pump & Machinery Corp., Harrison, N. J., gives two pages on hydraulic bypass and check valves, showing cross-sectional views and listing sizes and capacities.

WELDING ELECTRODES. Numerous applications of inorganic flux welding electrodes are described in a new booklet published by the Metal & Thermit Corporation, 120 Broadway, N. Y., N. Y. The booklet describes the welding of mild steel and boiler plate and stainless steel alloys, manganese steel, high carbon steel and stainless iron.

WIRE CLOTH. General Catalog No. 32, just issued by the Newark Wire Cloth Company, Newark, N. J., is a handbook on wire cloth and wire cloth products and contains 100 4½ x 7 in. pages, listing wire cloth in various metals and meshes. A glossary of terms is included.

WOODWORKING EQUIPMENT. Bulletin GEA-1586, issued by the General Electric Co., Schenectady, N. Y., describes electric equipment for woodworking.